OVERVIEW

The approach and methods used by the Washington Department of Fish and Wildlife (WDFW) in developing the Comprehensive Wildlife Conservation Strategy (CWCS) were determined or influenced by a number of factors, including Congressional appropriations language, Guiding Principles from the International Association of Fish and Wildlife Agencies (IAFWA), instructions from the National Advisory and Acceptance Team (NAAT) and our own Guiding Principles, which are provided below and explained in Chapter I, Introduction and Background.

A. Identify Species of Greatest Conservation Need

Guiding Principle 1: "Leave no species behind." Address the conservation of species and habitats with identified greatest conservation need, while recognizing the importance of keeping common species common.

There are two different ways to view the conservation and management of wildlife and wildlife habitat, at any level. One is to see wildlife species and populations as the products or outputs of conservation, with habitat conservation being the primary avenue for ensuring healthy, sustainable wildlife populations. The other is to see habitat conservation as the conservation objective, with wildlife populations as a necessary function or product of good habitat conservation. Either approach or mindset can yield sound wildlife conservation, and both are observed and practiced by wildlife conservation agencies across the United States.

The Washington Department of Fish and Wildlife (WDFW) has invested in the proposition that the identification and conservation of habitat across the landscape is the best way to ensure the long-term survival and productivity of the state's fish and wildlife resources. This management philosophy began in the 1940s, when WDFW initiated a visionary program of acquiring wildlife habitat, and continues today with a strong focus on conserving important habitat on both public and private land, through both regulatory and non-regulatory means. WDFW currently owns or controls about 840,000 acres of wildlife habitat statewide. A statewide discussion of Wildlife Species Distribution, Status and WDFW Management Priorities is included in Chapter III, State Overview.

It is WDFW's considered view that Congress' intent in establishing and funding the State Wildlife Grants Program was to promote the development of species-driven state CWCS documents with emphasis on those species that are not hunted or fished and for which funding is unavailable or limited. Our interpretation is that Congress and the National Advisory and Acceptance Team (NAAT) have directed that all elements of the Washington CWCS be driven by the state Species of Greatest Conservation Need list, which was developed over a period of months by WDFW, in consultation with our public and private conservation partners.

The process of developing a Species of Greatest Conservation Need (SGCN) list began in the spring of 2004. Our initial approach was to tie together all the various fish and wildlife species included on existing priority species lists, including WDFW's Priority Habitat and Species (PHS), the Global and State species rankings adopted by the Washington Natural Heritage Program, and the various target species identified in the ecoregional assessments (EAs) being developed by WDFW, in partnership with the Washington Department of Natural Resources and The Nature Conservancy. Our reason for selecting these specific, vetted lists was that they had already undergone considerable scientific peer review and public involvement. Following is a list of sources and their descriptions:

WDFW Priority Habitats and Species (PHS): The PHS List is a catalog of habitats and species considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include Federal Endangered and Threatened species, State Endangered, Threatened, Sensitive and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. http://wdfw.wa.gov/hab/phspage.htm

WDFW Species of Concern: This list includes only native Washington fish and wildlife species that are listed as endangered, threatened, or sensitive, or as candidates for these designations. The list also incorporates all federally listed threatened and endangered fish and wildlife species. Endangered, threatened, and sensitive species are legally established in Washington Administrative Codes. Candidate species are established by WDFW policy. Washington State monitor species are those that require management, survey, or data emphasis for one or more of the following reasons: 1) they were classified as endangered, threatened, or sensitive within the previous five years; 2) they require habitat that is of limited availability during some portion of their life cycle; 3) they are indicators of environmental quality; and 4) there are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened or sensitive species. Go to: http://wdfw.wa.gov/wlm/diversty/soc/concern.htm

Washington Natural Heritage Program: The Washington Natural Heritage Program (WNHP) is located within the Washington Department of Natural Resources. The primary tool used by WNHP to prioritize individual plant and animal species is the global and state ranking system used by NatureServe and its member Natural Heritage programs.

The ranking system used by NatureServe and WNHP facilitates a quick assessment of a species' rarity. For individual species, the global and state ranks are used as the starting point in the process of assigning priorities. Each rated species is then assigned one of the following priority rankings:

Priority 1: These species are in danger of extinction across their range, including Washington. Their populations are critically low or their habitats are significant degraded or reduced.

Priority 2: These species may become endangered across their range or in Washington if factors contributing to their decline or habitat loss continue.

Priority 3: These species are vulnerable or declining and could become endangered or threatened throughout their range without active management or removal of threats to their existence.

New information provided by field surveys, monitoring activities, consultation and literature review improves accuracy and keeps rankings current. Each month, four to seven local data centers exchange data with NatureServe to achieve a network-wide data exchange over the course of a year. Therefore, the subnational rankings presented in NatureServe Explorer are only as current as the last data exchange with each local data center coupled with the latest site update. This data is always shown in the small print provided with each report.

For more information on NatureServe, go to NatureServe's website at http://www.natureserve.org. For more information on the Washington Natural Heritage Program, go to: http://www.dnr.wa.gov/nhp/

Ecoregional Assessments (EA): The ecoregional assessments being developed by WDFW and other public and private partners are explained in more detail later in this chapter, in Chapter VI, Washington's Ecoregional Conservation Strategy, and in Appendix 12. Animal target species for EAs were chosen from the following groups:

Imperiled species are those having a global rank of G1, G2 or G3, as determined by the Washington Natural Heritage Program.

Imperiled subspecies are those having a global rank of T1, T2 or T3, as determined by the Washington Natural Heritage Program.

Government classified are those listed as endangered or threatened or proposed for listing by the U.S. Fish and Wildlife Service or National Marine Fisheries Service.

Species of special concern include:

- Species of state concern that are 1) ranked as S1, S2 or S3 by Washington Natural Heritage Program, or 2) listed or candidates for listing as endangered or threatened by WDFW.

- Declining species that 1) have exhibited a significant, long-term decline in habitat and/or numbers, and 2) are subject to a continuing high degree of threat.
- Endemic species restricted to the ecoregion or part of the ecoregion. We defined endemic as one for at which at least 75 percent of its geographic range occurs in the ecoregion.
- Disjunct species with populations that are geographically isolated from populations in other ecoregions.
- Vulnerable species are usually abundant, may not be declining, but some aspect of their life history makes them especially vulnerable, such as habitats needed for migratory stopovers or winter range.
- Keystone species are those whose impact on a community or ecological system is disproportionately large for their abundance. They contribute to ecosystem function in a unique and significant manner through their activities. Their removal causes major changes in community composition.
- Wide-ranging species that depend on vast areas. These species include top-level predators such as the gray wolf and northern goshawk. Wide-ranging species can be especially useful in examining linkages among conservation areas in a true conservation network.
- Globally significant examples of species aggregations like migratory stopover sites or overwintering areas that contain significant numbers of individuals of many species.
- Partners in Flight (PIF) species for whom a conservation priority score for a species indicated need for special attention. This guideline applies only to birds.
- Species guilds are groups of species that share common ecological processes or patterns. It is often more practical to target such groups as opposed to each individual species of concern.

Partners In Flight (PIF): Partners In Flight is an international partnership to document and reverse the decline of Neotropical migratory birds. The Partners in Flight species assessment system uses six criteria, each scored from one to five, to rank or categorize species at the national level. These criteria are meant to assess the overall vulnerability of the species to endangerment and have bee added together to give an overall ranking. The highest possible score is 30, indicating the greatest vulnerability, and the lowest possible score is 6, which indicates a secure species. Go to: http://www.partnersinflight.org/

Process and Criteria Used to Develop the Species of Greatest Conservation Need List:

Species Ranking Criteria: In developing the Species of Greatest Conservation Need list for Washington, WDFW considered about 700 terrestrial, aquatic and marine species—both vertebrates and invertebrates—that were ranked by the five species conservation programs listed above. Then, using the expertise of WDFW staff and invited taxa experts from other agencies, an initial draft list of SGCN was produced in the form of an Excel matrix that included a number of fields, including source species lists, associated habitats and management and species recovery plans. This matrix was heavily weighted toward species that had already been recognized as being in trouble and therefore listed on federal and state lists of endangered, threatened and sensitive species lists.

This initial SGCN list was presented to the Washington CWCS Advisory Committee in a workshop held on May 27, 2004. The Advisory Committee's reaction was positive regarding the development of the matrix itself; however, they felt that the list overlooked or discounted many species for which we do not yet have adequate information, species that are underfunded for conservation, and species that have "fallen through the cracks"—in that they may be headed for trouble but have not yet been included on state or federal species of concern lists. The Advisory Committee also felt that the list did not adequately reflect one of our guiding principles: "keeping common species common".

After the May 27, 2004 meeting with the Advisory Committee, we developed a new process and new criteria for developing a Species of Greatest Conservation Need list for the Washington CWCS. The following table shows the criteria used to develop this new species list. The criteria guidelines were designed to not only consider the biological needs of fish and wildlife species, but also other factors such as the extent of current knowledge about the species, current expenditures, and conservation measures already in place to protect the species or its habitat. These new criteria were drafted by WDFW's Wildlife Program and were given a thorough peer review within WDFW and approved by members of the CWCS Advisory Committee. The criteria were then given to members of the taxa expert review teams to use as guidance in their rankings. A list of taxa committee members is included as Appendix 11.

WASHINGTON CWCS SPECIES RANKING CRITERIA

<table>
<tr><th>FACTOR</th><th>CRITERIA</th><th>NOTES</th></tr>
<tr><td colspan="3">I. CONSERVATION CONCERNS – Y AXIS (High score = high priority)</td></tr>
<tr><td>THREATS</td><td>Number of threats
Irreversibility, immediacy of threats
Rank 1 through 5

1 = Low threat
3 = Medium threat
5 = High threat

Threats are to be considered for WA only unless species is migratory and has a known limiting factor outside the state.</td><td>Threats are defined as human-caused impacts.

WA state actions may not be restricted to addressing threats within the state. For example, funds might be used to attend international conferences for the conservation of a particular species.

A species with different threats in different regions can be treated as different species in the matrix, i.e. western meadowlark (westside) and western meadowlark (eastside)</td></tr>
<tr><td>CURRENT STATUS</td><td>Degree of concern (WDFW listings, National Heritage Program global and state rankings).
Automatically calculated in spreadsheet using assigned values for each rank.

<table>
<tr><th colspan="2">WDFW</th><th colspan="2">NHP</th></tr>
<tr><td>E</td><td>3</td><td>G1</td><td>3</td></tr>
<tr><td>T</td><td>3</td><td>G2</td><td>3</td></tr>
<tr><td>S</td><td>2</td><td>G3</td><td>2</td></tr>
<tr><td>C</td><td>2</td><td>G4</td><td>1</td></tr>
<tr><td>M</td><td>1</td><td>G5</td><td>0</td></tr>
<tr><td></td><td></td><td>S1</td><td>3</td></tr>
<tr><td></td><td></td><td>S2</td><td>3</td></tr>
<tr><td></td><td></td><td>S3</td><td>2</td></tr>
<tr><td></td><td></td><td>S4</td><td>1</td></tr>
<tr><td></td><td></td><td>S5</td><td>0</td></tr>
</table></td><td>Where a species has dual rankings, the ranking of highest concern was chosen for consideration.

Number values for each rank were assigned by expert judgment.

Species with too little information for ranking (i.e. GU or SU) were not assigned a value. Expert judgment will be needed on a species-by-species basis.

Rank 1 through 3

1 = Low status
2 = Medium status
3 = High status</td></tr>
<tr><td>SOCIO/ ECONOMIC VALUE</td><td>Rank 1 through 3

1 = Low value
2 = Medium value
3 = High value</td><td>Cultural icon (i.e. tribal)
Commercial/game species
Non-consumptive recreational
Flagship species
Keystone species
Indicator species</td></tr>
<tr><td>VULNERABLE</td><td>Rank 1 through 5

1 = Low vulnerability
3 = Medium vulnerability
5 = High vulnerability</td><td>Vulnerability is defined through elements of life history.

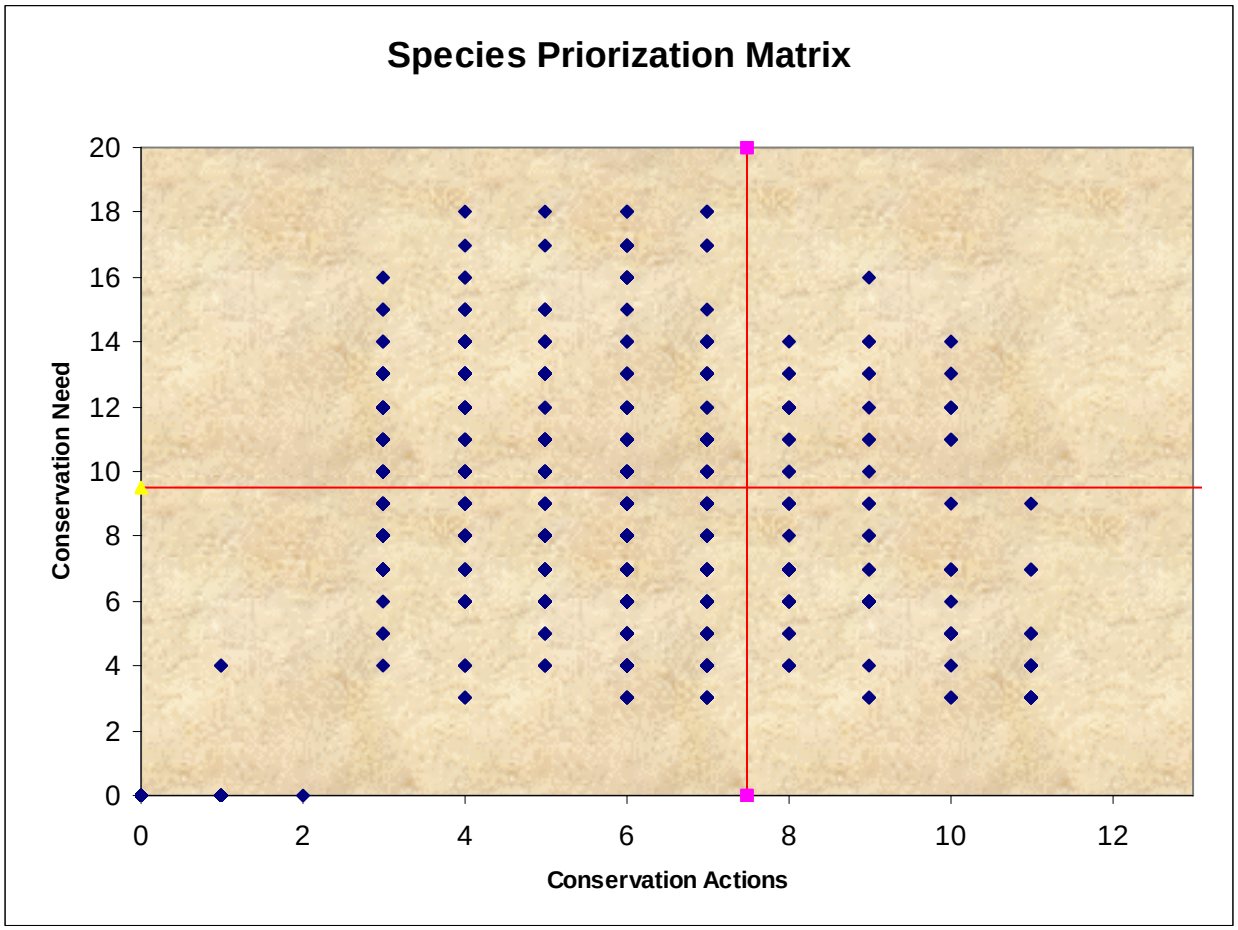
Reproductive mechanisms
Scale of endemism
Specialist
Restricted distribution
Peripheral range (breeding vs. non)</td></tr>
</table>

FACTOR	CRITERIA	NOTES
CONSERVATION ACTIONS – X AXIS (High score = low priority)		
KNOWLEDGE	**Adequate knowledge to manage species in the state of Washington.** 1 = Low knowledge in WA 2 = Medium knowledge in WA 3 = High knowledge in WA	Knowledge of species applicable to Washington populations. Example: Consider ecological relationships, limiting factors, population dynamics.
EXPENDITURES	**Non-SWG sources of funding available or being used** 1 = Inadequate 2 = Partly adequate 3 = Mostly adequate	Based on what you know, give us your opinion. Example: 1 = <$50K 2 = $50K - $500K 3 = >$500K
ADEQUACY OF CONSERVATION MEASURES IN PLACE	**Amount of current protection related to species need:** 1 = Inadequate 3 = Partly adequate 5 = Mostly adequate	Consider the following: Regulation Planning efforts Acquisition Easement Population manipulation Enforcement/compliance Education Community involvement/concern Mitigation

EXAMPLE of Conservation Measures for the Northern Spotted Owl: Resulting score would be a 3.

CONSERVATION MEASURES	INADEQUATE	PARTLY ADEQUATE	MOSTLY ADEQUATE
Regulation		x	
Planning efforts		x	
Acquisition		x	
Easement		--	
Population manipulation	x		
Enforcement/compliance	x		
Education		x	
Community involvement/concern		x	
Mitigation	x		

Points were assigned to each criterion in the "Conservation Concerns" section and in the "Conservation Actions" section of the ranking matrix. The criteria were grouped into two main categories: 1) Conservation Concerns factors related to current ecological condition of the species, and 2) Conservation Actions factors related to the level of conservation attention currently given to each species. Criteria were totaled for each main factor. Totals for Conservation Concerns factors were plotted against the totals for Conservation Actions factors. A draft threshold was selected at the mid-point of each axis to divide the species list into four quarters. Species whose total points fell **above** the cutoff number for "Concerns" and **below** the cutoff number for "Actions" (i.e., the upper left quartile on the following scatter plot) were placed on the Species of Greatest Conservation Need (SGCN) list. Final thresholds were selected by expert opinion within the WDFW Wildlife Diversity Division to ensure that a selected list of species with known high conservation concern and currently receiving significantly less than recommended conservation attention fell within the SGCN quartile.



Species Ranking Process: It took most of the rest of 2004 to assemble taxa ranking teams of species experts and have them evaluate almost 700 fish and wildlife species, invertebrates included. For anadromous salmonids, the groupings used for evaluation were genetic diversity units (GDUs) rather than species. A genetic diversity unit is a group of genetically similar stocks that is genetically distinct from other such groups within a species.

The taxa evaluation teams were comprised primarily of WDFW personnel, with several invited staff from the Department of Natural Resources' Natural Heritage Program, the Washington Department of Transportation and the Oregon Natural Heritage Program (the only beetle specialist we could find). They met as often as required to assimilate the ranking criteria and evaluate the species assigned to their taxa evaluation team. Many of the species evaluated for the SGCN list ranked high due to biological concerns such as threat and vulnerability; some were targeted because their recovery or conservation efforts were not considered to be adequately funded. Others were included because their life history or habitat relationships are poorly understood and need more research and/or management dollars directed to them. Only native animal species were considered in developing this list. No major wildlife taxon was excluded from consideration. Game and commercially harvested species were included if they met other ranking criteria, i.e., if they were on one of the source lists. There were many heated discussions among taxa team members about which species should be included or not included on the SGCN list. However, the final result is an SGCN list (see Appendices 1 and 2) that we feel not only meets the expectations of Congress, but also meets the current conservation and funding needs of Washington's native fish and wildlife resources.

The resulting Species of Conservation Concern (SGCN) list for Washington, along with rankings, habitat associations, ecoregion occurrences, management and recovery plans is attached as Appendices 1 and 2.

Species Conservation Tables: The Species of Greatest Conservation Need matrix, included as Appendices 1 and 2, includes all 600 species ranked by WDFW. In addition, a table showing information on status, distribution, life history, conservation problems, conservation strategies and monitoring activities for the SGCN is included as Chapter IV. Other enhanced matrices, which include information on status and trends, problems and actions, are included as Appendices 9 and 10.

A separate list of Species of Greatest Conservation Need was also included in each ecoregional chapter. These ecoregional species lists were not developed independently of the statewide effort, but are simply those SGCN species that are known to occur in each particular ecoregion. For each ecoregional habitat description, we also included a list of species commonly associated with that habitat, again only a subset of the ecoregional species list.

Salmon Recovery: The issue of how to treat salmon conservation and salmon recovery in the Washington CWCS was a topic of intense discussion since the beginning of the planning process. Washington's eleven species and subspecies of native salmonid fish not only have important biological, cultural, commercial and recreational value; salmon are important indicators of watershed health throughout the Pacific Northwest. More than two-thirds of WDFW's budget and staff are directly or indirectly devoted to salmon production, salmon recovery, and salmon harvest allocation. WDFW is also leading or heavily involved in the development and implementation of salmon recovery plans at many different levels, from individual watersheds to the international waters of the Pacific Ocean, Puget Sound/Georgia Basin, and the Columbia River system.

Because salmon are so important to the overall discussion of the state's fish and wildlife resources, it was decided to include them developing WDFW's Species of Greatest Conservation Need list. Although it made no sense to rank only eleven species, or to rank hundreds of salmon stocks and populations, it did work to rank salmon by GDU, and that is what senior fisheries biologists at WDFW did. A list of salmon GDUs included in Washington's Species of Greatest Conservation Need (SGCN) list is included as Appendix 2.

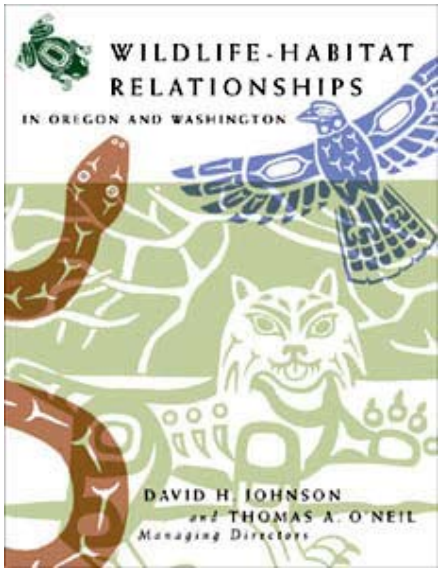
For most other discussion of salmon conservation and recovery, including statewide Habitats of Conservation of Concern, problems and strategies, it was decided to refer CWCS readers to various other salmon planning efforts and collaborative plans, a list of which is included as Appendix 7. A sense of balance was hopefully achieved between ignoring salmon, which would have been contrived, and discussing all aspects of salmon conservation, which could have overwhelmed all other discussion of species and habitat conservation in the CWCS.

B. Identify Habitats of Conservation Concern

While the State Wildlife Grants program and the CWCS guidelines are essentially species-driven, much of the conservation effort that will be directed to identified Species of Greatest Conservation Need will be habitat-related, including habitat protection, restoration, and enhancement measures carried out by WDFW and its public and private conservation partners. The NAAT guidelines not only require that we identify wildlife habitat types and communities that are essential to the conservation of Species of Greatest Conservation Need, but that we provide information on the extent and condition of these habitats.

Unlike the evaluation and ranking of species, WDFW did not consider it necessary to design new criteria or do any original analysis to determine the associated habitats essential to the Species of Greatest Conservation Need. These species-habitat associations have been well established recently through two efforts, both involving and funded by WDFW and other conservation partners:

Wildlife-Habitat Relationships of Oregon and Washington (WHROW), published by Oregon State University in 2001. The co-authors of this remarkable 736-page book (with accompanying appendices) are David H. Johnson, a wildlife biologist and WDFW employee at the time of publication, and Thomas A. O'Neil, a principle with the Northwest Habitat Institute. WHROW provided WDFW with an invaluable source of current information on species/habitat relationships. A primary emphasis of the book was to develop high-quality data sets on wildlife habitats and their associated species. This was achieved by defining, describing, and depicting various component details about wildlife habitats. This approach moves away from defining what is primary or secondary habitat for a species, and towards identifying the overall strength and context of the relationship between the wildlife species and their habitat(s). The strength of the relationship is designated as *Closely Associated, Generally Associated*, or *Present* within the wildlife habitat types or structural conditions. In addition, a confidence rating was assigned to the relationship and its strength, based on current knowledge. This approach allows for an individual species, as well as multiple species, to be assessed across habitats.



Using the data sets provided by WHROW and the Interactive Biological Information System (IBIS), described below, we were able to develop our SGCN master list and cross-reference species relationships across all defined habitats across the state. Using this data, we were then able to compare the frequency of close and general associations between Species of Greatest Conservation Need and WHROW habitats and select CWCS priority habitats based on SGCN dependence on those habitats.

Statewide and ecoregional habitat maps included in the CWCS are based on WHROW habitat source data.

Tom O'Neil and the Northwest Habitat Institute developed the Interactive Biological Information System (IBIS), an informational resource developed to promote the conservation of Northwest fish, wildlife, and their habitats through education and the distribution of timely, peer-reviewed scientific data. IBIS contains extensive information about Pacific Northwest fish, wildlife, and their habitats, and attempts to reveal and analyze the relationships among these species and their habitats. IBIS is described in more detail in Chapter III, State Overview.

A copy of *Wildlife-Habitat Relationships of Oregon and Washington (WHROW*) is included with the Washington CWCS as Appendix 13. For more information on data collection and analysis techniques used in WHROW data sets, go to: http://www.nwhi.org/ibis/home/ibis.asp

Ecoregional Assessments (EA) (described in Appendix 12): To complete the Ecoregional Assessments for Washington, expert technical teams collaborate on a series of analyses based on methods developed by The Nature Conservancy, NatureServe and other conservation organizations. These technical teams analyze terrestrial and aquatic plants, animals and ecological systems.

Each EA technical team begins their analysis by selecting the species, communities and ecological systems that would serve as the conservation targets, i.e., the elements of biodiversity that should be included in priority conservation areas. This results in the selection of terrestrial species targets, aquatic species targets, rare plant community types, and coarse filter system targets. These system targets are the major habitat types that make up the terrestrial and aquatic environments for each ecoregion. They are used as targets based on the hypothesis that by ensuring their full representation in the portfolio, the majority of species in each ecoregion—including the vast number of poorly studied or unknown species—will also be included. In this way the coarse filter system targets serve as a substitute or surrogate for common species and species with inadequate data.

For each of these targets, all available records of location and status in the ecoregion are gathered and reviewed. Goals are then set for each target to serve as instructions or benchmarks for the identification of the portfolio of priority conservation areas. These goals describe how many populations (for species targets) or how much area (for system targets) the portfolio should include to represent each target, and how those target occurrences should be distributed across the ecoregion to ensure good representation of genetic diversity and hedge against local extirpations. More details of the development of ecoregional assessments are included in Appendix 12.

The Washington Natural Heritage Program provided a crosswalk comparison of habitat classification systems developed by WHROW, NatureServe, and WDFW's Priority Habitats and Species. This crosswalk is included as Appendix 14.

Statewide and Ecoregional Habitats of Conservation Concern: The master SGCN ranking matrix (Appendices 1 and 2) shows associated WHROW habitats for each species ranked for the statewide SGCN list. A list and description of priority WHROW habitats selected by the CWCS is also attached as Appendix 8. For purposes of reference only, Appendix 14 cross-references WHROW habitat classifications with WDFW PHS Habitats and NatureServe's Ecological System-based Land Cover Types for clarification. Habitat descriptions and evaluations included in the list of statewide Habitats of Conservation Concern were reviewed for accuracy by respected scientists within and outside the WDFW, including members of the Washington Natural Heritage Program. Chapter III, State Overview of the Washington CWCS also includes a table that groups all 29 of the WHROW wildlife habitats that occur in Washington into three priority groupings, Priority One, Priority Two, and Other. These statewide priority groupings were made by simply associating the wildlife species on the SGCN list with their associated habitats, as determined by WHROW. These habitat priorities were reviewed by WDFW managers and are compatible with other systems and lists of priority habitats employed by WDFW, including the existing PHS system.

Each of the ecoregional chapters in the Washington CWCS includes a list of those WHROW wildlife habitats found in that ecoregion titled Ecoregional Habitat Overview, as well as those habitats, which are considered to be a management priority for that ecoregion. As with the statewide list of priority habitats, ecoregional priority habitats

were determined by deciding which habitats were most closely associated with species on the SGCN list found in that ecoregion.

In the future, the Washington CWCS's habitat classification and maps will be updated using "ecological systems." This will make the CWCS consistent with the USGS National Land Use/Land Cover mapping that is currently in progress. This coarse-filter classification is being adopted by all federal agencies and by NatureServe for regional conservation planning.

C. Identify Major Problems and Conservation Strategies for Species and Habitats

Guiding Principle 2: "Build a plan of plans." Construct the Washington CWCS from a large body of existing work, including nine ongoing ecoregional assessments.

The Washington Department of Fish and Wildlife experiences most of the same problems, threats and opportunities related to fish and wildlife conservation as other state wildlife agencies in the United States. Although the diversity of species and habitats may be greater than in many other states, the range of opportunities and possible actions available to WDFW and its conservation partners is similar to those available in other states. Fish and wildlife conservation in Washington—and other states, for that matter—is limited only by the laws in place to protect wildlife and habitat, the extent to which the public and decision makers will enforce these laws, and the funding available for conservation.

Statewide Problems and Conservation Strategies: In developing the CWCS for Washington, many other plans and assessments were reviewed and summarized. Some of these plans are described in Chapter III, State Overview. A narrative discussion of major statewide conservation problems and issues is also included in Chapter III, State Overview. WDFW did not attempt to prioritize the statewide problems and conservation strategies discussed in Chapters III. All of the major conservation problems discussed in Chapter III are serious problems, although their relative importance may vary from ecoregion to ecoregion. Subsequent to the release of the draft CWCS in June 2005, additional matrices were developed to provide more information on the life history, population status, distribution, problems, strategies and recommended conservation actions for each of the roughly 200 fish and wildlife species included on the SGCN list. These new matrices are discussed below.

Ecoregional Problems and Conservation Actions: Each ecoregional chapter of the Washington CWCS includes a list of Ecoregional Conservation Partnerships, as well as Major Plans and Assessments reviewed and used to develop each ecoregional discussion. Each chapter also includes a discussion of identified problems, as well as conservation actions that will be pursued in each ecoregion to address these problems. Many of these problems and conservation actions were extracted or synthesized from other plans. For the purposes of ensuring that the full range of conservation problems and threats were considered, WDFW staff consulted *Conventions for Defining, Naming, Measuring, Combining and Mapping Threats in Conservation, Draft 1* (Salafsky et al., December 2003).

Much of the staff work spent on developing these ecoregional chapters was completed after the draft CWCS was released in June 2005. The discussion of ecoregional conservation actions for wildlife species and associated habitats was expanded in scope and detail for the final CWCS.

Species Conservation Matrices: Conservation problems and corresponding strategies and actions are often interconnected at a range of levels. Whether a certain condition has an impact on an ecosystem, a habitat or a species, all three may be affected in some way. Adequately addressing problems at larger scales can have beneficial indirect effects at finer scales, and it is important to consider each individual species and the unique problems that affect the abundance and vitality of each.

Therefore, we created a set of matrices to detail each SGCN species' life history, status, distribution, general and specific problems, and conservation actions. Expanded text matrices for each taxon are included in Chapter IV, Species of Greatest Conservation Need, and a problems/actions checklist matrix that summarizes this information is attached as Appendix 10. In this way, each species may be targeted for specific actions, and cross references may group suites of species that are adversely affected by the same problems and which would benefit from the same conservation actions. Each of these matrices summarizes important conservation problems and actions for all Species of Greatest Conservation Need.

Species information, conservation problems and actions were refined from a variety of sources including ecoregional assessments, subbasin plans, management and recovery plans, status reports, current peer-reviewed literature, and expert opinion.

D. Provide for Periodic Monitoring of Species, Habitats and Conservation Actions

Monitoring is a key element in managing WDFW's fish, wildlife and habitat conservation programs, but WDFW's monitoring activities had never been pulled together and described in one place before. In 2005, WDFW Director Jeff Koenings appointed one of his senior policy staff as WDFW's new Monitoring Coordinator and asked her to develop a report that would summarize current and proposed monitoring activities for Washington's CWCS. She met with managers from the Fish, Wildlife and Habitat Programs on a number of occasions to ensure that key monitoring programs were included in the summary, and to design some future steps to monitor fish and wildlife species, associated habitats and biodiversity. The result of this internal coordination effort is described in Chapter VII, Monitoring and Adaptive Management.

E. Provide for the Periodic Review and Revision of the CWCS

Development of the CWCS is perhaps the largest and most complex conservation planning effort undertaken by WDFW since the agency's creation in 1994 (by merger of separate Departments of Wildlife and Fisheries). It was a huge effort for a relatively new agency without a history of comprehensive planning. Developing a

new Species of Greatest Conservation Need list alone was a protracted and often painful process, but was worth the effort because it narrowed the field of species eligible for new funding from thousands to less than 200, including many invertebrates and other less well-known animals that were never before considered.

WDFW went into the CWCS process committed to developing the best comprehensive wildlife strategy it could produce in the less than two years allocated to the process. WDFW is equally committed to following through on the various strategic recommendations in the CWCS by reviewing these recommendations on a regular basis, revising the species and habitat priorities when necessary and appropriate, and adopting or developing fair and rational approaches to allocating responsibilities and funding for implementation, both within WDFW and among its various public and private conservation partners. The subject of CWCS review and revision is discussed in more detail in Chapter VII, Monitoring and Adaptive Management.

F. Coordinate Development of the CWCS with Federal, State, Local and Tribal Partners

The Washington Department of Fish and Wildlife has emphasized coordination with many public and private conservation partners in the development of its CWCS, with a strong emphasis on those partners who have a primary interest or statutory responsibility for fish and wildlife conservation. Both elements of coordination and public involvement have been addressed in an Outreach Plan discussed later in this chapter. CWCS coordination was accomplished at three different scales:

National: WDFW staff have worked closely with the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies (IAFWA) during all phases of the CWCS process. We have participated in national CWCS conferences in Burnet, Texas and Nebraska City, Nebraska in 2004; our Director gave a keynote talk at the Nebraska conference.

Regional: Throughout the CWCS development process, WDFW staff have met on a regular basis with Federal Aid staff at the U.S. Fish and Wildlife Service, Region One in Portland, Oregon. WDFW has participated in regular conference calls with the Development Assistance Team (DAT) representative from Region One, as well as other western state fish and wildlife agencies. Early in the process WDFW also took the lead in setting up coordination meetings with CWCS coordinators from Oregon and Idaho, as well as Northwest representatives from Defenders of Wildlife and The Nature Conservancy. These meetings were held at the WDFW regional office in Vancouver, Washington, until everyone got too busy with CWCS production to meet on a regular basis.

Statewide: WDFW staff coordinated the development of the Washington CWCS with a wide range of internal and external organizations, including our own management program staff in Olympia headquarters, our field staff in six administrative regions around the state, and other state, federal and tribal wildlife agencies. Teams of technical experts were convened as necessary to develop our Species of Greatest Conservation Need list and associated habitats; these teams were comprised mostly of headquarters staff from Olympia. Meetings were held in all WDFW regional offices to involve regional staff in development of the nine ecoregional chapters of the CWCS. WDFW also closely coordinated the development of its CWCS with the Washington Natural Heritage Program of the Department of Natural Resources, as well as staff from The Nature Conservancy of Washington,

Defenders of Wildlife and Audubon Washington. Much of this coordination took place around certain issues on an ad hoc basis.

G. Incorporate Opportunities for Public Involvement into Development of the CWCS

One of the first tasks undertaken by WDFW in the CWCS process was the development of an Outreach Plan in late 2003. This plan built upon the outreach efforts of other plans such as the subbasin plans and ecoregional assessments, which all have their own public involvement and agency coordination elements. The CWCS Outreach Plan addresses the interagency coordination requirements of both Essential Element 6 and the Public Involvement requirement of Essential Element 7. Although review opportunities were provided for the general public in the draft CWCS review process, primary outreach attention was given to those agencies, organizations and stakeholder groups most affected by the strategies outlined in Washington's CWCS. The Outreach Plan also addresses WDFW's various internal publics, ranging from the Fish and Wildlife Commission and Department staff to various standing advisory committees to the Director.

The CWCS Outreach Plan, included as Appendix 4, outlines the following three phases or points of contact with agencies, NGOs and the public:

Initial Outreach: From November 2003 through June 2005 we met with existing WDFW advisory councils, an appointed CWCS Advisory Committee, federal and state agencies, Washington Indian tribes, the Governor's Office, key legislators and the Washington State Association of Counties on many occasions. At these briefings we provided an overview of the CWCS process and indicated that once we developed a draft CWCS document, we would provide opportunities to these same agencies and publics to comment on the draft and shape the future State Wildlife Grants (SWG) program for Washington.

We met with a wide range of agencies and organizations in our initial outreach phase; however, as indicated above, our main outreach focus was on agencies and organizations with special responsibilities for fish and wildlife conservation—our public and private conservation partners. See Appendix 15, Outreach Record. Treaty Indian tribes, for instance, have "co-management" status under federal treaties for managing and harvesting salmon, shellfish and some game animals. The Washington Department of Natural Resources and USDA Forest Service manage vast areas of public lands that provide habitat for Washington's fish and wildlife. The Washington Association of Counties and the Planning Association of Washington represent local elected officials and county planners responsible for implementing Washington's Growth Management Act, which is the most comprehensive state law addressing the protection of habitat and other identified "critical areas." Many of our conservation partners are listed in Appendix 5.

Special outreach efforts were directed toward conservation partners such as The Nature Conservancy, Audubon Washington and Defenders of Wildlife, as well as

private timber and agriculture groups, which are heavily regulated and have a direct influence on Washington's rural landscape. Our initial outreach message was intended to secure interest and involvement in the CWCS process, but we also wanted to assure industry groups such as the Washington Farm Bureau and the Washington Forest Protection Association (timber industry lobby) that WDFW does not see the State Wildlife Grants program and CWCS requirements as a venue for justifying or recommending new regulatory programs.

A CWCS Advisory Committee was appointed by the Director of Fish and Wildlife in early 2004 and met periodically as a committee throughout the development of the CWCS. At each meeting we updated the committee on the process of Washington's CWCS and asked for their feedback on our approach. The committee included professionals experienced in their respective industries and fields. They provided honest, constructive feedback and served as a valuable sounding board for development of the CWCS. Members of the CWCS Advisory Committee are listed in Appendix 11.

Draft Strategy Review: Our original outreach plan called for two rounds of review for the draft CWCS; the first in March or April 2005 for our internal publics, the second in May and June 2005 for our external publics, including other conservation agencies. Because the production schedule for the draft CWCS took longer than expected and, in order to meet our August deadline for submittal to the NAAT, we combined both external and internal publics into one review period.

On June 1, 2005 WDFW sent out a statewide press release announcing that the draft CWCS would be posted on WDFW's website and that we would sponsor a series of six public meetings around the state in June. This press release is included as Appendix 16. On June 7, 2005 a first draft of the Washington CWCS was posted on WDFW's website at: www.wdfw.wa.gov/wlm/cwcs, and we immediately began conducting public meetings at our regional offices in Yakima, Spokane, Ephrata, Vancouver and Montesano. We also had a meeting with the CWCS Advisory Committee on June 9 in Olympia to brief them on the draft.

The public meetings were successful in giving interested publics an opportunity to review and ask questions about the draft CWCS, including draft ecoregional chapters, by having headquarters and regional staff walk through a copy of the draft projected on a large screen. The best-attended meetings were in Ephrata and Vancouver; the lowest attendance was in Montesano and Spokane, with one and two attendees each, respectively. When the public meetings were concluded, we scheduled follow-up meetings with major conservation partners, including the Washington Department of Natural Resources, U.S. Fish and Wildlife Service, and the USDA Forest Service.

The public was asked to provide comments on the draft CWCS to WDFW by June 30, 2005; this deadline was later extended to July 8 for the CWCS Advisory Committee and state and federal conservation agencies. Some conservation partners, such as The Nature Conservancy and Defenders of Wildlife, met our short review deadline; other review comments, mostly from state and federal agencies, trickled into WDFW through the week of July 25, 2005. Written comments on the draft CWCS were received from a number of interested individuals, advisory committee members, and the following conservation partners:

Defenders of Wildlife
The Nature Conservancy
U.S. Army, Yakima Training Center

U.S. Fish and Wildlife Service
USDA Forest Service
Washington Biodiversity Council
Washington Department of Natural Resources
Washington Farm Bureau
Washington Forest Protection Association

Post-submittal Outreach and Publicity: Once the final CWCS has been submitted to the NAAT and approved, WDFW will initiate a third round of outreach to the outdoor media and the public. The focus of this effort will be on the final CWCS and how it guides the future course of wildlife conservation in Washington. We will refer people to the web-based version of the CWCS, which will include many "hot links" to other websites and material referenced in the CWCS. We will also develop an Executive Summary of the Washington CWCS in the fall of 2005 and use it in this last phase of our outreach. The executive summary will be a full-color brochure, approximately 8 to 12 pages in length, and should be helpful in briefing elected officials, the media, and other publics that did not have the time or interest to read the entire CWCS. We hope to put copies of the executive summary in the hands of elected officials and others who can help us address the various problems and issues identified in the CWCS.

Outreach Record: Our outreach contacts from late 2003 through August 2005 are documented in an Outreach Record, included as Appendix 16.

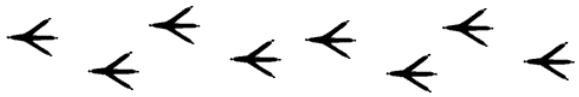
Outreach Materials: A number of outreach tools were developed by WDFW prior to publicizing the CWCS process. These include the CWCS website at www.wdfw.wa.gov/wlm/cwcs, a number of CWCS PowerPoint slideshows tailored to fit different audiences, and two color brochures: one describes the Washington CWCS, and the other illustrates the interactive relationships between the CWCS and other planning efforts at different scales (Appendices 17 and 18).

LIST OF ACRONYMS

ALEA	Aquatic Lands Enhancement Account
BMP	Best Management Practices
BPA	Bonneville Power Administration
CAO	Critical Area Ordinance
CAPS	Contracts and Projects System (WDFW)
CARA	Conservation and Reinvestment Act of 1999
CBFWA	Columbia Basin Fish and Wildlife Authority
CCA	Candidate Conservation Agreement
CCMP	Comprehensive Conservation and Management Plan
CCP	Comprehensive Conservation Plan
CRMP	Comprehensive Resource Management Plan
CRP	Conservation Reserve Program
CWCS	Comprehensive Wildlife Conservation Strategy
DPS	Distinct Population Segment
EA	Ecoregional Assessment
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPA	Forest Protection Act
GAP	Gap Analysis Program
GDU	Genetically Distinct Unit
GIS	Geographic Information Systems
GMA	Growth Management Act
HCP	Habitat Conservation Plan
IAFWA	International Association of Fish and Wildlife Agencies
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IPM	Integrated Pest Management
IWJV	Intermountain West Joint Venture
NAFTA	North American Free Trade Agreement
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service

PBDEs	Polybrominated Diphenyl Ethers (fire retardants)
PBTs	Persistent Bioaccumulative Toxins
PCBs	Polychlorinated Biphenyls
PEI	Pacific Education Institute
PHS	Priority Habitats and Species
PSNERP	Puget Sound Nearshore Ecosystem Restoration Project
RHA	Riparian Habitat Area
RMZ	Riparian Management Zone
SGCN	Species of Greatest Conservation Need
SMA	Shoreline Management Act
SSHIAP	Salmon & Steelhead Habitat Inventory & Assessment Project
SWG	State Wildlife Grants
TDR	Transfer of Development Rights
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WAC	Washington Administrative Code
WADNR	Washington Department of Natural Resources
WDFW	Washington Department of Fish and Wildlife
WHROW	*Wildlife Habitat Relationships in Oregon and Washington* (Johnson & O'Neil 2000)
WNHP	Washington Natural Heritage Program
WWRP	Washington Wildlife and Recreation Program

GLOSSARY



Abiotic: Non-living components of an ecosystem; basic elements and compounds of the environment.

Adaptive management: An adaptive approach to management where we use the best scientific knowledge and technologies, clearly recognize knowledge gaps, build shared expectations among those who have a stake in ecosystem outcomes, monitor actions, and adjust management actions accordingly.

Algae: The common name for the relatively simple type of unicellular or multicellular plant which is never differentiated into root, stem and leaves, contains chlorophyll *a* as its photosynthetic pigment, has no true vascular system, and has no sterile layer of cells surrounding its reproductive organs.

Alluvial: Pertaining to river and stream deposits.

Alluvial soil: Soil formed in material deposited by the action of running water, such as a floodplain or delta.

Alpine tundra: A treeless region above the treeline of high mountains, characterized by cold winters and short, cool summers and having permafrost below a surface layer that may melt in summer.

Amphipod: Any of a large order of small, usually aquatic crustaceans with a laterally compressed body, for example, beach fleas.

Anadromous: Referring to the life cycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born.

Anaerobic: Referring to an environment in which oxygen is absent, or to a process which occurs only in the absence of oxygen, or to an organism that lives, is active, or occurs on the absence of oxygen, such as some yeasts or bacteria.

Annelids: Any of a phylum (Annelida) of usually elongated, segmented coelomate invertebrates, such as earthworms, various marine worms, and leeches.

Anoxic: Greatly deficient in oxygen; oxygenless.

Anthropogenic: Of, relating to, or resulting from the influence of humans on nature.

Aquaculture: The cultivation or farming of aquatic organisms such as fish and shellfish under captive conditions for purposes of human consumption.

Aquatic ecosystem: Any body of water such as a stream, lake or estuary, and all organisms and nonliving components within it, and functioning as a natural system.

Aquatic integrity: A mosaic of well connected, high-quality water and habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and taxonomic lineages, and the taxonomic and genetic diversity necessary for long-term persistence and adaptation in a variable environment.

Arboreal: Living in the canopies of trees.

Archaebacteria: A taxonomic kingdom of bacteria, including sulphur-dependent bacteria, methane-producing bacteria, and halophilic bacteria.

Areas of environmental concern: Areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important natural systems or processes, or to protect life and safety from natural hazards.

Arthropod: Invertebrate animals with a segmented body and jointed appendages, for example, spiders, bees and crabs.

Aspect: The direction a slope faces with respect to the cardinal compass points.

Association: A stable grouping of two or more plant species that characterize or dominate a type of biotic community.

Autecology: A subdivision of ecology that deals with the relationship of individuals of a species to their environment.

Avalanche chute: An area where periodic snow or rockslides prevent the establishment of forest conditions; typically shrub and herb dominated.

Avian: Relating to or derived from birds.

Avifauna: The birds of a specific region or period.

Barrens: A level area with poor, usually sandy or serpentine soils that is sparsely forested or unable to support normal vegetative cover and that generally has a low level of productivity. Barrens are frequently dominated by specialized groups of endemic plants.

Benthic: Occurring at the bottom of a body of water, for example, a seabed, riverbed, or lake bottom.

Benthos: In freshwater and marine ecosystems, the collection of organisms both attached to or resting on the bottom sediments and burrowed into the sediments.

Bioaccumulation: The process by which chemical contaminants become more concentrated in the tissues of organisms as they pass higher up the food chain. Heavy metals and pesticides such as DDT are stored in the fatty tissues of animals and are passed along to predators of those animals. The resulting concentrations eventually reach harmful levels in predators at the top of the food chain.

Biodiversity: The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of genera, families and still higher taxonomic levels, includes the variety of ecosystems, that comprise both the communities of organisms within particular habitats and the physical conditions under which they live.

Biogeographic: The spatial distribution patterns of organisms in relation to change through time (paleoecological, historical, current, and future).

Biogeographical region: Any geographical region characterized by distinctive flora or fauna (such as a biome or an ecoregion).

Biogeography: The science that deals with the geographical distribution of animals and plants.

Biological diversity: The full variety of living organisms and their assemblages; the genetic variation within and between populations of species, and the many processes that link organisms and their physical environments into ecological systems.

Biomass: The total mass of all living organisms or of a particular set of organisms in an ecosystem or a trophic level in a food chain; usually expressed as a dry weight or as the carbon, nitrogen, or caloric content per unit area.

Biome: A major regional ecological community characterized by distinctive life forms and principal plant or animal species, such as tropical rain forest, tundra, grassland, or a desert.

Bioregion: A territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system or related, interconnected ecosystems.

Biota: The plants and animals of a specific region or period, or the total aggregation of organisms, in the biosphere.

Bivalve: A mollusk whose body is enclosed by two hinged valves or shells.

Blowdown: An extensive toppling of trees by wind within a relatively small area that significantly alters the small-scale climate within the ecosystem.

Boreal forest: The circumpolar, subarctic forest of high northern latitudes that is dominated by conifers. It is found south of the tundra in the Northern Hemisphere and often contains peaty or swampy areas.

Brackish: Water that is saline but not as salty as seawater.

Braided channel: A stream consisting of a network of interlacing small channels separated by bars, which may be vegetated and stable or barren and unstable.

Breeding Bird Survey: The North American Breeding Bird Survey (BBS) begun in 1966 to collect standardized data on bird populations along more than 3,400 survey routes across the continental United states and southern Canada for more than 250 species.

Broad scale: Encompassing a wide area.

Brood parasitism: The laying of eggs by one bird species in the nest of another bird species and the subsequent brooding of the egg and raising of the young by the parasitized host, usually to the detriment of the host's young.

Bunchgrass: Any of several grasses, especially of the western United States, that grow in tufts rather than forming turf, for example, the genus *Andropogon*.

Calcareous: Consisting of or containing calcium carbonate; a soil rich in calcium salts, derived from limestone or chalk. Also, an organism which has an affinity for such an alkaline or basic soil.

Candidate species: A species being considered for listing as a federally or state listed endangered or threatened species.

Canopy: A layer of foliage in a forest stand; most often refers to the uppermost layer of foliage.

Canopy closure: The degree to which the canopy blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy, as openings in the branches and crowns must be accounted for.

Carrying capacity: The maximum population of a given organism that a particular environment or habitat can sustain; implies continuing yield without environmental damage, often denoted as *K*.

Catchment: The area drained by a river or body of water.

Cetacean: Any of an order of aquatic, mostly marine mammals that include the whales, dolphins, porpoises, and related forms.

Channelization: The straightening of rivers or streams by means of an artificial channel.

Chlorofluorocarbons (CFCs): A group of gaseous compounds that contain carbon, chlorine, fluorine, and sometimes hydrogen, and are aerosol propellants and in the manufacture of plastic foams. Also referred to as greenhouse gases.

Cirque: A steep hollow, often containing a small body of water, found at the upper end of a mountain valley.

Clearcut: An area where the entire stand of trees has been removed in one cutting.

Climate: Generalized statement of the prevailing weather conditions at a given place, based on statistics of a long period of record. Includes seasonality of temperature and moisture.

Climax: The final stage of succession in an ecosystem. Also a community that reached a steady state under a particular set of environmental conditions.

Coarse filter: Refers to the communities or ecological systems which, if protected in sufficient quantity, should conserve the vast majority of species in the ecoregion.

Coarse woody debris (CWD): Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Cohort: Individuals all resulting from the same birth-pulse, and thus all of the same age.

Commensal: Referring to the relationship between two kinds of organisms in which one obtains food or other benefits from the other without damaging or benefiting it.

Community: Any grouping of populations of different organisms that live together in a particular environment.

Connectivity: Condition in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.

Conservation biology: The body of knowledge that deal with the careful protection, utilization and planned management of living organisms and their vital processes to prevent their depletion, exploitation, destruction, or waste.

Conservation strategy: A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area, i.e. a viable population.

Continental shelf: The shallow, gradually sloping seabed around a continental margin not usually deeper than 650 feet and formed by submergence of part of a continent.

Copepods: any of a large subclass (Copepoda) of usually minute freshwater and marine crustaceans that form an important element of the plankton in the marine environment and in some fresh waters.

Corridor: A more or less contiguous connection between landmasses or habitats; a migration route that allows more or less uninhibited migration of most of the animals of one faunal region to another. In terms of conservation biology, a connection between habitat fragments in a fragmented landscape.

Cover: Vegetation used by wildlife for protection from predators, to mitigate weather conditions, or to reproduce. May also refer to the protection of soil and the shading provided to herbs and forbs by vegetation.

Critical habitat: Under the Endangered Species Act, critical habitat is defined as the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species and that may require special management considerations or protection, and specific areas outside the geographic area occupied by a listed species when it is determined that such areas are essential for the conservation of the species.

Crosswalk: A comparison of two different vegetation or habitat classification systems and resolving the differences between them to form a common standard.

Crown fires: Fires that spread from tree crown to tree crown, usually indicative of particularly hot (high intensity) fires in dry conditions.

Crustacean: Any of a large class (Crustacea) of mostly aquatic mandibulate arthropods that have a chitinous or calcareous and chitinous exoskeleton, a pair of often modified appendages on each segment, and two pairs of antennae; includes lobsters, shrimps, crabs, wood lice, water fleas, and barnacles.

Cyanobacteria: A large and varied group of bacteria that possess chlorophyll *a* and which carry out photosynthesis in the presence of light and air, producing oxygen. They were

formerly regarded as algae and were called “blue-green” algae. The group is very old, and cyanobacteria are believed to have been the first oxygen-producing organisms on Earth.

Deciduous: Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally.

Declining: Species that have exhibited significant, long-term reduction in habitat/and or numbers, and are subject to continuing threats in the ecoregion or state.

Defoliators: Insects that feed on foliage and act to remove some or all of the foliage from a tree, shrub or herb.

Degradation: The breaking down of a substance into smaller or simpler parts, usually by erosion.

Delta: An alluvial deposit at the mouth of a river or tidal inlet. Deltas occur when a sediment-laden current enters an open body of water, at which point there is a reduction in the velocity of the current, resulting in rapid deposition of the sediment, as at the mouth of a river where the river discharges into the sea or a lake.

Demersal: Living at or near the sea floor but having the capacity for active swimming.

Demography: The quantitative analysis of population structure and trends; population dynamics.

Desertification: The process by which an area or region becomes more arid through loss of soil and vegetative cover. The process is often accelerated by excessive, continuous overstocking and drought.

Detritus: Debris or waste material, usually organic, such as dead or partially decayed plants and animals, often important as a source of nutrients; or small particles of minerals from weathered rock, such as sand and silt.

Dewatering: The removal of water from a stream/river network, typically for irrigation, industrial or human use; commonly changes a network that developed by concentrating flows from stream/river branches to mainstems, to mainstems branching to canals, which reduces the flow in the mainstems.

Disjunct: Distinctly separate; a discontinuous range in which one or more populations are separated from other potentially interbreeding populations by a sufficient distance to preclude gene flow between them.

Dispersal: The movement, usually one-way and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.

Distributary: A river branch flowing away from the main stream.

Disturbance: An effect of a planned human management activity or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Disturbance regime: The pattern of intervals between disturbance and severity of disturbance. For landscapes, this can be for a given disturbance, such as fire, or for a complex of disturbances.

Diurnal: Occurring or active only in daylight.

Diversity: The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Drawdown: A lowering of the water level in a reservoir or other body of water.

Ecological approach: Natural resource planning and management activities that assure consideration of the relationship between all organisms (including humans) and their environment.

Ecological disequilibrium: A system that has unequal relationships of inputs and outputs that result in erratic (and unpredictable) successional patterns and associated responses to disturbance.

Ecological drainage unit (EDU): aggregates of watersheds that share ecological characteristics. These watersheds have similar climate, hydrologic regime, physiography, and zoogeographic history.

Ecological element: The individual constituent of the whole. For example, vegetation patch, stream reach, road, city site, or large snag.

Ecological function: The activity or role performed by an organism or element in relation to other organisms, elements or the environment.

Ecological integrity: The maintenance of native and desired non-native species and associated processes.

Ecological process: A series of actions, changes or functions that produce a resulting condition for biota, elements or the environment. For example, succession, decay, photosynthesis, food chain, fire, drought or flood.

Ecological succession: The chronological sequence of vegetation and associated animals in an area; or, continuous colonization, extinction, and replacement of species' populations at a particular site, due either to environmental changes or to the intrinsic properties of the plants and animals.

Ecological type: A category of land having a unique combination of potential natural community, soil, landscape features, climate and differing from other ecological types in its ability to produce vegetation and respond to management.

Ecology: The relationship of species, including humans, and their environment.

Ecoregion: A continuous geographic area in which the environmental complex produced by climate, topography and soil is sufficiently uniform to develop characteristics of potential major vegetation communities.

Ecoregional assessment target species: A wildlife species selected by ecoregional assessments as a focus for conservation assessment. For a detailed description of how

target species were selected for each ecoregion, please refer to the ecoregional assessment documents.

Ecosystem: A community of organisms and their physical environment that interact as an ecological unit.

Ecosystem function: The major processes of ecosystems that regulate or influence the structure, composition and pattern. These include nutrient cycles, energy flows, trophic levels (food chains), diversity patterns in time/space development and evolution, cybernetics (control), hydrologic cycles and weathering processes.

Ecosystem-based management: The careful and skillful integration of ecological, economic, social and managerial principles to conserve, enhance, and restore ecosystems (including their functions, processes, constituent species, and productive capacities) to maintain their long-term viability and integrity while seeking desired conditions for uses, products, values and services.

Ecosystem viability: The ability to maintain diversity, productivity, resilience to stress health, renewability and/or yields of desired values, resource used, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Ecosystems approach: The ecosystem approach embodies three fundamental concepts: designating the physical boundary of the system and its parts; understanding the interactions of the parts as a functioning whole; and understanding the relation between the system and its context (external factors that influence the system and also internal information that must be synthesized to be understood at the scale of the defined system).

Ecotone: The boundary or transitional zone between adjacent communities containing the characteristic species of each, such as the edge of a woodland next to a field or lawn.

Ecotype: A locally adapted population of a species that has a distinctive limit of tolerance to environmental factors; a genetically uniform population of a species resulting from natural selection by the special conditions of a particular habitat factor.

Edaphic: Pertaining to soil or to the physical, chemical, and biological properties of the soil or substratum, which influence associated biota, such as pH and organic matter content.

Edge effect: The tendency for a transitional zone between communities (an *ecotone*) to contain a greater variety of species and more dense populations of species than either community surrounding it.

Element occurrence (EO): A term originating from the methodology of the Natural Heritage Network that refers to a unit of land or water on which a population of a species or example of an ecological community occurs. For communities, these EOs represent a defined area that contains a characteristic species composition and structure.

Emergent: An aquatic plant having most of its vegetative parts above water. Also, a tree that reaches or exceeds the level of the surrounding canopy.

Encroachment: Conditions where the succession/disturbance regimes have been changed to allow transition to dominance by species or structures that are not adapted to the biophysical succession/disturbance regime.

Endangered species: Any species which is in danger of extinction throughout all of its range; a species that is federally listed as Endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act.

Endemic: Belonging or native to a particular people or geographic region; a genetically unique life form.

Environment: The complex of climatic, soil and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Ephemeral streams: Streams that contain running water only sporadically, such as during and following storm events.

Epipelagic: The oceanic zone extending from the surface to about 650 feet, where enough light penetrates to allow photosynthesis.

Epizootic: An outbreak of disease (an epidemic) in nonhuman animals, or pertaining to such an outbreak.

Equilibria/Equilibrium: A system that has cyclic successional patterns or multiple stable states, and associated response in disturbances.

Estuary: A semi-enclosed coastal body of water that has a free connection with the open sea and where fresh water derived from land drainage (usually mouths of rivers) is mixed with seawater; often subject to tidal action and cyclic fluctuations in salinity.

Eutrophication: The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates, which typically promote excessive growths of algae, decomposition of which depletes oxygen, causing the death of other organisms.

Exotic species: Species that occur in a given place, area or region as the result of direct or indirect, deliberate or accidental introduction by humans, permitting the species to cross a natural barrier to dispersal.

Extinction: The dying out of a species, or the condition of having no remaining living members; also, the process of bringing about such a condition.

Extirpation: The loss or removal of a species from one or more specific areas but not from all areas.

Fauna: The animal life of a region or geological period.

Fen: A marshy, low-lying wetland covered by shallow, usually stagnant, and often alkaline water that originates from groundwater sources.

Feral: Relating to plants or animals which have escaped from domestication, and to their descendants.

Fine filter: Species of concern or rare communities that complement the coarse filter, helping to ensure that the coarse filter strategy adequately captures the range of viable native species and ecological communities. Endangered or threatened, declining, vulnerable, wide-ranging, very rare, endemic and keystone species are some potential fine filter targets.

Fire regime: The characteristic frequency, extent, intensity, severity and seasonality of fires in an ecosystem.

Fluvial: Pertaining to rivers or streams and their action.

Forb: An herbaceous plant that is not a grass.

Fragmentation: Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation.

Gallery forest: A narrow strip of forest along the margins of a river in an otherwise unwooded landscape.

Gap analysis: The process of identifying and classifying components of biological diversity to determine which components already occur in protected areas and which are not present or are under-represented in protected areas.

GAP (National Gap Analysis Program): Gap analysis is a scientific method for identifying the degree to which native animal species and natural communities are represented in the present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation "gaps". The purpose of the Gap Analysis Program (GAP) is to provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists and policy makers with the information they need to make better-informed decisions.

Gastropod: Any of a large class (Gastropoda) of mollusks, usually with a univalve shell or no shell and a distinct head bearing sensory organs, such as snails and slugs.

Geographic Information System (GIS): A spatial type of information management system that provides for the entry, storage, manipulation, retrieval, and display of spatially oriented data.

Geomorphology: The study of landforms on a planet's surface and of the processes that have fashioned them.

Global rank: An assessment of a biological element's relative imperilment and conservation status across its geographic distribution, ranging from G1 (critically imperiled) to G5 (secure). Assigned by the Natural Heritage Network, global ranks for species and communities are determined by the number of occurrences or total area of coverage (communities only), modified by other factors such as condition, historic trend in distribution or condition, vulnerability, and impacts.

Graminoids: Grasses and grass-like plants such as sedges.

Groundfish: A bottom-dwelling fish, especially one of commercial importance such as cod, haddock, pollock or flounder.

Guild: A group of species having similar ecological resource requirements and foraging strategies and therefore having similar roles in the community.

Habitat: The place, including physical and biotic conditions, where a plant or animal usually occurs.

Habitat connections: A network of habitat patches linked by areas of like habitat. The linkages connect habitat areas within the watershed to each other and to areas outside the watershed. These connections include riparian areas, mid-slopes, and ridges. In the case of old growth forest habitat connections, each connection is planned to be sufficiently wide (at least 1,000 feet) to retain interior old growth-associated species.

Habitat fragmentation: The breaking up of a habitat into unconnected patches interspersed with other habitat, which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines.

Habitat type: Place where an animal or plant normally lives, often characterized by a dominant plant for or physical characteristic.

Heterogeneity: Variation in the environment over space and time.

Heterogeneous: consisting of diverse or dissimilar parts; having non-uniform structure or composition.

Hibernacula: Plural of hibernaculum, a protective covering or structure, such as a cave or tree cavity, in which an animal remains dormant for the winter.

Historic: The approximate 1,000-year time period prior to Euro-American settlement (substantial effects in Washington assumed to have begun by the mid-1800s).

Holocene: The present, post-Pleistocene geologic epoch of the Quaternary period, including the last 10,000 years; the most recent postglacial period.

Home range: The geographic area within which an animal restricts its normal, daily activities.

Human dimension: An integral component of ecosystem management that recognizes people are part of ecosystems, that people's pursuits of past, present and future desires, needs and values have and will continue to influence ecosystems and must be included in ecosystem management.

Hybridization: Any crossing of individuals of different genetic composition, often belonging to separate species, resulting in hybrid offspring.

Hydrological cycle: The movement of water from the sea through the air to the land and back to the sea.

Hydrology: The study of the movement of water from the sea through the air to the land and back to the sea; the properties, distribution and circulation of water on or below the Earth's surface and in the atmosphere.

Hypoxic: Deficient in oxygen.

Impact: The combined concept of ecological stresses to a target and the sources of that stress to the target. Impacts are described in terms of severity and urgency.

Impoundment: A natural or artificial body of water held back by a dam.

Indicator species: An organism whose presence or state of health is used to identify a specific type of biotic community or as a measure of ecological conditions or changes occurring in the environment.

Indigenous: A species that occurs naturally in an area; native.

Integrated pest management (IPM): A pest management philosophy based on an understanding of natural habitat growth and development, habitat pest dynamics, and the interaction of the two.

Integrated resources management (IRM): The simultaneous consideration of ecological, physical, economic and social aspects of lands, waters and resources in developing and carrying multiple-use, sustained-yield management.

Intermittent stream: Any non-permanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Intertidal: Relating to the littoral zone above the low-tide mark.

Invertebrate: An animal without a backbone, such as snails, worms and insects.

Karst: A limestone landscape characterized by skins, underground streams and caverns.

Keystone species: Organisms that play dominant roles in an ecosystem and affect many other organisms. The removal of a keystone predator from an ecosystem causes a reduction of the species diversity among its former prey.

Krummholz: A discontinuous belt of stunted forest or scrub typical of windswept alpine regions close to treeline; a wind-deformed tree at high elevations.

Lacustrine: Pertaining to or living in lakes or ponds.

Landscape: A spatially heterogeneous area with repeating patterns of elements and associated disturbance regimes, with similar climate and geomorphology.

Landscape connectivity: The spatial contiguity within the landscape; a measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers.

Landscape ecology: The relationships of structure, function and change in a heterogeneous land area composed of interacting ecosystems. Structure, function and

change refer to the patterns and processes of terrestrial, aquatic, hydrologic, social and economic systems across space and through time.

Lek: A mating system among birds during which males display communally at a traditional site (one used year after year), for example, sage-grouse.

Lentic: Related to still waters such as ponds, lakes or swamps.

Levee: A raised embankment along the edge of a river channel, often constructed as protection against flooding. Natural levees result from periodic overbank flooding, when coarser sediment is immediately deposited because of a reduction in river velocity.

Lichen: A composite organism consisting of a fungus and algae or cyanobacteria living in symbiotic association.

Life history: The significant features of the life cycle through which an organism passes, with particular reference to strategies influencing survival and reproduction.

Linkages: Route that permits movement of individual animals from one habitat type to another similar habitat type.

List of endangered or threatened species: A listing of animals and plants administratively determined to meet legal criteria for protection under provisions of the U.S. Endangered Species Act.

Littoral zone: The biogeographic zone in a body of fresh water where light penetration is sufficient for the growth of plants; the intertidal zone of the seashore.

Loess: Unconsolidated sediment deposited by wind. Loess is usually composed or unstratified fine sand or silt.

Lotic: Relating to or living in moving water, such as a river or stream.

Macroclimate: Climate that lies just beyond the modifying irregularities of landform and vegetation.

Macrofauna: Animals large enough to be seen with the naked eye.

Management disturbances: Intentional, planned human disturbance that changes the structure and composition of a landscape element, landscape pattern, or regional composition, such as timber harvest, thinning, range improvement, livestock grazing, prescribed fire planned ignition, fire suppression, etc.

Marine protected areas (MPAs): Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment (IUCN 1988).

Marsh: An ecosystem of more or less continuously waterlogged soil dominated by emersed herbaceous plants but without a surface accumulation of peat. A marsh differs from a swamp in that it is dominated by rushes, reeds, cattails and sedges, with few if any woody plants, and differs from a bog in having soil rather than peat at its base.

Matrix: The most extensive and most connected landscape element type present, which plays the dominant role in landscape functioning. Also a landscape element surrounding a patch.

Mature forest: Generally used in an economic sense to indicate that a forest has attained harvest age.

Maximum sustainable yield: The maximum yield or crop which may be harvested year after year without damage to the system, or the theoretical point at which the size of a population is such as to produce a maximum rate of increase.

Megafauna: The largest size category of animals in a community.

Meiofauna: That part of the microfauna that inhabits algae, rock fissures, and superficial layers of the muddy sea bottom. They are smaller than 1 millimeter but larger than 0.1 millimeter.

Mesic: Neither wet (hydric) nor dry (xeric); intermediate in moisture, without extremes.

Metapopulation: A group of populations, usually of the same species, which exist at the same time but in different places.

Microclimate: The climate that prevails in a small area, usually in the layer near the ground.

Mollusk: An organism in the phylum Mollusca (for example snails, clams, or squids), characterized by soft, unsegmented body parts enclosed in a shell.

Monitor species: Washington State monitor species are those that require management, survey, or data emphasis for one or more of the following reasons: 1) they were classified as endangered, threatened, or sensitive within the previous five years; 2) they require habitat that is of limited availability during some portion of their life cycle; 3) they are indicators of environmental quality; and 4) there are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened or sensitive species.

Monitoring: A process of collecting information to evaluate whether objectives of a management plan are being realized.

Montane: Of, relating to, growing in, or being the biogeographical zone of relatively moist, cool upland slopes below the timberline, often dominated by large coniferous trees.

Moraine: An accumulation of boulders, stones or other debris carried and deposited by a glacier.

Mosaic: Heterogeneous ecological conditions on a landscape usually produced by the variable, patchy effects of disturbances: a patchwork of vegetation communities within a landscape as determined by environmental conditions.

Native: Plants or animals that are indigenous to a given place; the pre-Euro-American settlement system.

Natural conditions: Plant and animal communities where humans have not directly impacted either the plant community or the soil by such activities as logging, grazing or cultivation.

Natural variability: Range of the spatial, structural, compositional and temporal characteristics of ecosystem elements during a period specified to represent "natural" conditions.

Nearshore marine zone: The area of the marine environment extending from the supratidal area above the ordinary or mean high water line to the subtidal area. In the Puget Trough ecoregion, the nearshore marine area extends below to –130 feet, because beyond that depth data were less available. This also approximates the photic zone, or depth of macrophytes.

Neotropical migrant: A bird that nests in temperate regions and migrates to the Neotropical faunal region, which includes the West Indies, Mexico, Central America, and that part of South American within the tropics.

Nonnative (also exotic, introduced, and alien): A plant or animal that is not native to the area in which it occurs; it was either purposely or accidentally introduced.

Nonpoint: Not from a single, well-defined site. Nonpoint sources are pollution-producing entities not tied to a specific origin, such as an individual smokestack; including runoff, which washes pollutants from roads into storm sewers and bodies of water or agricultural chemicals from lawns, fields and golf courses.

Obligate: Essential, necessary; unable to exist in any other state, mode or relationship; restricted to one particularly characteristic mode of life.

Obligate species: A plant or animal that occurs only in a narrowly defined habitat such as a tree cavity, rock cave, or wet meadow.

Old growth: Referring to an ecosystem or community, particularly a forest, which has not experienced intense or widespread disturbance for a long time relative to the life spans of the dominant species and that has entered a late successional stage; usually associated with high diversity of species, specialization, and structural complexity.

Oligotrophic: Waters or soils that are poor in nutrients and have low primary productivity.

Overgrazing: Continued heavy grazing that exceeds the recovery capacity of the plant community and creates a deteriorated range.

Palustrine: Pertaining to wet or marshy habitats.

Parasite: An organism that is intimately associated with and metabolically dependent on another living organism (the host) for completion of its life cycle, and which is typically detrimental to the host.

Patch: Ecosystem elements (e.g. areas of vegetation) that are relatively homogeneous internally and that differ from what surrounds them.

Patch dynamics: The idea that communities are a mosaic of different areas (patches) within which nonbiological disturbances (such as climate) and biological interactions proceed.

Pathogen: A specific causative agent of a disease, such as a bacterium or a virus.

Pelagic: Referring to or occurring in the open sea.

Perennial stream: A stream that typically has running water on a year-round basis.

Peripheral: A species or community that only occurs near the edges of an ecoregion or state and is primarily located in other ecoregions or states.

Physiographic province: A region of the landscape with distinctive geographical features.

Physiography: Landform; physical geography.

Pioneer: The first species or community to colonize or recolonize a barren or disturbed area, thereby commencing a new biological succession.

Plant association: Stands of vegetation with similar combinations of species united into abstract types; a basic unit in plant community classification.

Playa: A nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water during wet periods. Playas are barren and usually saline.

Pleistocene: The earlier epoch of the Quaternary period or the corresponding system of rocks; 1.6 million to 10,000 years ago; the “Ice Age”.

Pluvial: Characterized by abundant rain.

Polychlorinated biphenyls (PCBs): A group of toxic, carcinogenic organic compounds containing more than one chlorine atom; very stable compounds, fat-soluble; they therefore accumulate in ever-higher concentrations as they move up the food chain.

Population: A group of individuals of a species living in a certain area that maintains some degree of reproductive isolation.

Population dynamics: The aggregate of changes that occur during the life of a population. Included are all phases of recruitment and growth, senility, mortality, seasonal fluctuation in biomass, and persistence of each year class and its relative dominance, as well as the effects that any or all of these factors exert on the population.

Population viability: Probability that a population will persist for a specified period across its range despite normal fluctuations in population and environmental conditions.

Prescribed fire: A fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from planned or unplanned ignitions.

Province: An area of land, less extensive than a region, having a characteristic plant and animal population.

Range: The area or region over which an organism occurs.

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing.

Recovery plan: A plan that lists the actions that must be taken and the objectives that must be reached before an organism is no longer endangered or threatened and may be removed from the list of endangered and threatened species.

Regime: A regular pattern of occurrence or action.

Region: The broadest scale of landscape ecology composed of a coarse-grained pattern of connected landscapes with contrasting boundaries that have a similar macroclimate and sphere of human activity and interest.

Relict: Persistent remnants of a formerly widespread species surviving in an environment that has undergone considerable change.

Resilience: The ability of an ecosystem to maintain diversity, integrity and ecological processes following disturbance.

Restoration, ecological: The reestablishment of pre-disturbance functions and related chemical, biological and hydrological characteristics.

Restoration, passive: The discontinuation of those activities that are causing degradation or preventing the ecosystem's recovery.

Riparian: Relating to, living, or located on the bank of a natural watercourse (such as a river) or sometimes of a lake or tidewater.

Riparian ecosystem: Ecosystems transitional between terrestrial and aquatic ecosystems. Also, streams, lakes, wet areas and adjacent vegetation communities and their associated soils that have free water at or near the surface.

Riparian zone: An area of vegetation adjacent to an aquatic ecosystem. It has a high water table, certain soil characteristics, and some vegetation that requires free (unbound chemically) water or conditions that are more moist than normal. This zone is transitional between aquatic and upland zones.

Riprap: A general term for large, blocky stones that are artificially placed to stabilize and prevent erosion along a riverbank or shoreline.

Risk analysis: A qualitative assessment of the probability of persistence of wildlife species and ecological systems under various alternatives and management options; generally also accounts for scientific uncertainties.

Rookery: Breeding or nesting place for some gregarious mammals and birds.

Runoff: Precipitation on land that runs off to a body of water.

Salmonid: Any of a family of elongate bony fishes (such as salmon or trout) that have the last three vertebrae upturned.

Sanitation: The removal of dead or damaged trees, or trees susceptible to insect and disease attack, such as intermediate and suppressed trees, essentially to prevent the spread of pest or pathogens and to promote forest health.

Savanna: A grassland-woodland mosaic vegetation type with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover.

Sediment: Materials that sink to the bottom of a body of water or materials that are deposited by wind, water or glaciers.

Sensitive species: A species not formally listed as endangered or threatened, but considered to be at risk as evidenced by: a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution.

Seral: Relating to a phase in the sequential development of ecological communities formed in ecological succession in a particular habitat and leading to a particular climax association; intermediate communities in an ecological succession.

Sere: The series of stages that follow one another in an ecologic succession; a series of biotic communities that follow one another in time on any given area of the Earth's surface.

Serotinous cones: Pinecones that remain on the tree for many years and are tightly closed until stimulated by the heat of a forest fire to oen and release seeds.

Sessile: Permanently attached to a substrate or established; not free to move about. Also, attached without a stalk.

Silviculture: The art and science of managing forest stands to provide or maintain structures, species composition and growth rates that contribute to forest management goals.

Site: The classification of land area based on its climate, physiographic (physical geography), edaphic (soil), and biotic factors that determine its suitability and productivity for particular species and silvicultural alternatives.

Slough: A swamp, marsh or muddy backwater.

Smolt: The stage in the life of salmon and similar fishes in which the subadult individuals acquire a silvery color and migrate down the river to begin their adult lives in the open sea.

Snag: A standing dead tree or stump that provides habitat for a broad range of wildlife, from beetle larvae (and the birds that feed upon them) to dens for raccoons.

Spawn: The eggs of certain aquatic organisms; also, the act of producing such eggs or egg masses.

Species: A group of organisms formally recognized as distinct from other groups; the taxon rank in the hierarchy of biological classification below genus; the basic unit of biological classification, defined by the reproductive isolation of the group from all other groups of organisms.

Species diversity: See *Biological diversity*.

Species richness: The absolute number of species in an assemblage or community.

Staging area: A traditional area, usually a lake, where birds that migrate in flocks rest and feed either immediately before or during migration. Many flocks may be gathered in such an area.

Stand composition: The representation of tree species in a forest stand, expressed by some measure of dominance (e.g., percent of volume, number, basal area, cover).

Stand structure: The physical and temporal distribution of plants in a stand.

Steppe: Specifically, the temperate, semiarid areas of treeless grassland in the mid-latitudes of Europe and Asia; more generally, any such grassland.

Stewardship: A land ethic for current and future generations that 1) encourages wise use and conservation of resources; 2) sustains and enhances productivity of resources; and 3) protects resources.

Stressors: Physical or biotic factors that stress individual organisms/communities.

Subalpine: The zone just below treeline on temperate mountains, usually dominated by a coniferous forest ecologically similar to boreal forest. The elevation of this zone increases with a decrease in latitude.

Subbasin: The fourth delineation within the hydrologic unit code system. provides a delineation generally of a river, or group of rivers, that flow into a basin.

Sublittoral zone: The deeper zone of a lake below the limit of rooted vegetation; the marine zone extending from the lower margin of the intertidal (littoral) to the outer edge of the continental shelf at a depth of about 650 feet.

Subsidence: The process of sinking or settling of a land surface or a crustal elevation because of natural or artificial causes.

Subspecies: A race of a species that is granted a taxonomic name; rules for designating subspecies are subjective, but subspecies are generally geographically distinct and form populations (not merely morphs) that differ to some degree from other geographic populations of the species.

Substrate: The surface of medium that serves as a base for something.

Subtidal: Applied to that portion of a tidal flat environment that lies below the level of mean low water for spring tides. Normally it is covered by water at all states of the tide. Often used as a general descriptive term for a shallow marine depositional environment.

Succession: The development of biotic communities following disturbances that produce an earlier successional community.

Successional stage: One in a series of usually transitory communities or developmental stages that occur on a particular site or area over a period of time.

Suitability: The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone.

Supratidal: Area above the mean high water line, such as the top of a bluff or the extent of a salt marsh in the upper intertidal; the upper limit of the nearshore marine zone.

Sustainability: The ability to sustain diversity, productivity, resilience to stress, health, renewability and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Sustainable development: The use of land and water to sustain production indefinitely without environmental deterioration, ideally without loss of native biodiversity.

Synergistic: Pertaining to the cooperative action of two or more agencies such that the total is greater than the sum of the component actions; combined action or operation.

Talus: Broken rock forming a more or less continuous layer that may or may not be covered by duff and litter.

Taxon (Taxa): Any organism or group or organisms of the same taxonomic rank; for example, members of an order, family, genus or species.

Threatened species: Any species that is likely to become an endangered species throughout all or a significant portion of its range; a species federally listed as Threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act.

Threshold: The boundary between ecological states that, once crossed, is not easily reversible and results in the loss of capacity to produce commodities and satisfy values.

Topography: The natural and constructed relief of an area.

Treeline: The upper limits of tree growth in mountains or at high latitudes.

Trophic: Pertaining to nutrition or to a position in a food web, food chain, or food pyramid.

Tundra: A level or rolling treeless plain in the arctic or subarctic regions; the soil is black and mucky, the subsoil is permanently frozen, and the vegetation is dominated by mosses, lichens, herbs and dwarf shrubs. A similar environment occurs in mountainous areas above the timberline.

Turbid: Having sediment or foreign particles stirred up or suspended; muddy.

Umbrella species: Species that, by being protected, may also protect the habitat and populations of other species.

Understory: The vegetation layer between the overstory or canopy and the groundcover of a forest community, usually formed by shade-tolerant species or young individuals of emergent species. May also refer to the groundcover if no tree or shrub layer is present.

Vertebrate: An animal with a backbone; includes mammals, birds, reptiles, amphibians, and fishes.

Viability: The ability of a species to persist for many generations or an ecological community or system to persist over some time period.

Viable population: A population that has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population in the area.

Vulnerable: Vulnerable species are usually abundant, may or may not be declining, but some aspect of their life history puts them at risk of decline (e.g., migratory concentration or rare/endemic habitat).

Watershed: An area or a region that is bordered by a divide and from which water drains to a particular watercourse or body of water.

Watershed analysis: A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to watersheds of approximately 20 to 200 square miles.

Wetland: A general term applied to land areas that are seasonally or permanently waterlogged, including lakes, rivers, estuaries and freshwater marshes; an area of low-lying land submerged or inundated periodically by fresh or saline water.

Widespread: A species or community typically found in the ecoregion or state, but common in several other ecoregions or states.

Wilderness: An area designated by congressional action under the 1964 Protection Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Woodland: A vegetation community that includes widely spaced large trees. The tree crowns are typically more spreading in form than those of forest trees and do not form a closed canopy. Grass, heath or scrub may develop between the trees.

Xeric: Dry; tolerating or adapted to dry conditions.

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APPENDIX 1:

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

					CRITERIA																											
				179	9.5	Concerns				7.5	Actions							PHS				Ecoregions										
Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	Criteria	Area	Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
6	AMABA01030	Preble's shrew	Sorex preblei	1	**13**	5	4	1	3	**4**	1	1	2	S1	Peripheral, unknown if still extant	M	Co	G4	S1											x		5, 8, 15-17, 19, 22, 25	
6	AMABA01230	Merriam's shrew	Sorex merriami	1	**10**	3	3	1	3	**6**	1	2	3	C		C		G5	S3	1	a	1,2,3								x	T	15, 16, 17, 18	
6	AMACC01060	Keen's myotis	Myotis keeni	1	**15**	5	4	1	5	**4**	1	1	2	S1	Peripheral	C	Co	G2	S1	1,2	a	6		T	x							1	
6	AMACC08010	Pallid Townsend's big-eared bat	Corynorhinus townsendii pallascens	1	**11**	3	3	2	3	**7**	2	2	3	C		C	Co	G4	S3	1,2	a	1,2,3,4,5,6					T	T	T	T	T	1-7, 9, 11-16, 19, 21, 23-25	MR 1991
6	AMACC08014	Pacific Townsend's big-eared bat	Corynorhinus townsendii townsend	1	**11**	3	3	2	3	**7**	2	2	3	C		C	Co	G4	S3	1,2	a	1,2,3,4,5,6		T	T	T	T					1-7, 9, 11-16, 19, 21, 23-25	MR 1991
6	AMAEB03040	White-tailed jackrabbit	Lepus townsendi	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G5	S2	1,3	a,c	1,2,3						T			x	15, 16	
6	AMAEB03050	Black-tailed jackrabbit	Lepus californicus	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G5	S2	1,3	a,c	1,2,3									x	16, 18	
6	AMAEB04010	Pygmy rabbit	Brachylagus idahoensis	1	**18**	5	5	3	5	**4**	2	1	1	E		E	E	G4	S1	1	a	1,2,3									T	16	SR 1993, RP 2003;1995
6	AMAFB03050	Olympic marmot	Marmota olympus	1	**10**	3	2	2	3	**6**	1	2	3	S3				G3	S3					T								9, 10	
6	AMAFB05010	Townsend's ground squirrel ssp.	Spermophilus townsendii townsendi	1	**13**	4	3	1	5	**4**	2	1	1	C		C		G4	S3	1	a	3									x	16, 17, 19	
6	AMAFB05020	Washington ground squirrel	Spermophilus washington	1	**12**	4	3	1	4	**3**	1	1	1	C		C	C	G3	S2	1	c	1,2									x	15, 16, 17	SR 2004d
6	AMAFB05200	Townsend's ground squirrel ssp.	Spermophilus townsendii nancyae	1	**12**	4	3	1	4	**3**	1	1	1	S2		C		G5	S2												x	16, 17, 18	
6	AMAFB07020	Western gray squirrel	Sciurus griseus	1	**16**	5	4	2	5	**4**	2	1	1	T		T	Co	G5	S2	1	a	2,3,5,6			T		T	T	T		x	2, 3, 7, 20	SR 1993, RP 2005, MR 1991
6	AMAFC01041	Brush Prairie pocket gopher	Thomomys talpoides douglasi	1	**13**	4	3	1	5	**3**	1	1	1	C		C		G5	S2	1	a	5			T							1, 4-9, 13-16, 19, 24, 25	SR 2005, MR 1991
6	AMAFC01060	Mazama (western) pocket gopher	Thomomys mazama	1	**14**	5	3	1	5	**4**	1	1	2	C		C	C	G4	S2	1	a	5,6		T	x							1-4, 7, 9,--11, 19, 20, 27	SR 2005d, MR 1991
6	AMAFF11012	Kincaid meadow vole	Microtus pennsylvanicus kincaid	1	**10**	4	1	1	4	**3**	1	1	1	M		M	Co	G5	S2												x	5, 19, 22, 25	
6	AMAFF11041	Shaw Island Townsend's vole	Microtus townsendii puget	1	**11**	2	4	1	4	**6**	1	3	2	S1				G5	S1						T							1-3, 11, 19, 22, 23, 26	
6	AMAFF11170	Gray-tailed vole	Microtus canicaudus	1	**10**	3	3	1	3	**4**	1	1	2	C		C		G4	S2	1,2	a	5			T							11, 19	
6	AMAGE07010	Killer whale	Orcinus orca	1	**17**	4	5	3	5	**7**	2	2	3	E		E		G4	S1	1,2	c	4,6		x	T							29, 30, 31, 32	SR 2004, RP 2004 fed
6	AMAGF01010	Pacific harbor porpoise	Phocoena phocoena	1	**13**	3	3	2	5	**5**	3	1	1	C		C		G4	SU	1,2	c	4,6		x	T							29, 30, 31	
6	AMAJA01030	Gray wolf	Canis lupus	1	**13**	3	5	3	2	**6**	2	1	3	E	Historical	E	T	G4	S1	1	a	1,2,3,4,5		T		T		T	T	T	T	4, 5, 7, 9, 10	RP 1991 fed, MR 1991
6	AMAJB01020	Grizzly bear	Ursus arctos	1	**18**	5	5	3	5	**7**	3	1	3	E	Historical	E	T	G4	S1	1	a	1,2,3,4				T		T	T	T		5, 8, 9, 10	RP 1993 fed, MR 1991
6	AMAJC03010	Steller sea lion	Eumetopias jubatus	1	**15**	5	4	2	4	**7**	2	2	3	T		T	T	G3	S2	1,2	c	4,6		x	x							27, 29, 30, 31	SR 1993, RP F
6	AMAJF01010	Marten (Coastal population)	Martes americana	1	**11**	4	0	2	5	**6**	2	1	3	S4				G5	S4	3	c	1,2,3,4,5,6	x	T								1, 4, 5, 6, 9, 24	MR 1991
6	AMAJF01021	Fisher	Martes pennanti pacifica	1	**15**	3	5	2	5	**6**	3	1	2	E	Historical	E	Co	G5	SH	1	a	1,2,3,4,5,6		x	x	T	T	T	T	T		1, 4, 5, 23	SR 1998, RP 2005, MR 1991
6	AMAJF03010	Wolverine	Gulo gulo	1	**14**	3	4	3	4	**7**	3	1	3	S1		C	Co	G4	S1	1	a	1,2,3,4,5,6				T	T	T	T	T		4, 9, 10, 24	
6	AMAJF04010	American badger	Taxidea taxus	1	**11**	4	0	3	4	**4**	1	1	2	S4				G5	S4				x					T	x	x	x	5, 7, 8, 13-17, 19 (pastures, CRP areas)	
6	AMAJF09010	Sea otter	Enhydra lutris	1	**18**	5	5	3	5	**7**	3	1	3	E		E	Co	G4	S2	1,2	c	6		x	x							30, 31	SR 2000, RP 2004;2000
6	AMAJH03010	Lynx	Lynx canadensis	1	**16**	4	4	3	5	**6**	3	1	2	T		T	T	G5	S1	1	a	1,2,3,4				x		T	T	T		4, 5, 6	SR 1999, RP 2001, MR 1991
6	AMALC01010	Elk (Nooksack herd, mixed)	C.e. nelsoni, roosevelti	1	**11**	4	0	3	4	**7**	2	2	3	S5	Close to extirpation due to variety of threats.			G5	S5				x			x						1, 2, 4, 9, 11, 19, 22-24	MP 2002, Game Plan 2003
6	AMALC02022	Columbian white-tailed deer	Odocoileus virginianus leucurus	1	**13**	3	5	2	3	**7**	3	2	2	E		E	E	G5	S1	1	c	5			T	T						1, 2, 3, 11, 19, 20, 22, 23	RP 1983 fed, MR 1991
6	AMALC04011	Woodland caribou	Rangifer tarandus	1	**17**	5	5	2	5	**6**	3	1	2	E		E	E	G5	S1	1	a	1							T			4, 5, 9, 22, 24, 25	RP 1994 fed, MR 1991, Coop 1996
6	AMALD01010	Pronghorn antelope	Antilocapra americana	1	**13**	3	5	2	3	**7**	1	2	4	X	Planned reintroduction																x	15, 16, 17, 18, 19	
5	ABNBA01030	Common loon	Gavia immer	1	**14**	4	3	3	4	**7**	3	1	3	S	East Cascades peripheral	S		G5	S2	1,2	b,c	1,2,3,4,5,6		T	x	T	T	T	T	T	x	21, 22, 28, 29, 30, 31	SR 2000, MR 2003
5	ABNCA04010	Western grebe	Aechmophorus occidentalis	1	**14**	4	3	2	5	**5**	2	2	1	C		C		G5	S3	1,2	b	1,2,3			x	T		x		x		x	21, 22, 28, 29, 30, 31	
5	ABNFC01010	American white pelican	Pelecanus erythrorhynchos	1	**17**	4	5	3	5	**4**	2	1	1	E		E		G3	S1	1,2	b,c	1,2,3,5							x		x	T	21, 22. Nests on islands, feeds in open water	MR 2003
5	ABNGA04010	Great blue heron	Ardea herodias	1	**10**	3	1	3	3	**6**	3	1	2	M		M		G5	S4	2	b	1,2,3,4,5,6			T	T	T		T	x	x		1, 2, 11, 19, 20-26, 28	MR 2003
5	ABNJB02030	Trumpeter swan	Cygnus buccinator	1	**12**	4	2	3	3	**7**	2	2	3	S3				G4	S3	2,3	3	1,2,3,4,5,6	x	x	T				T			T	19, 21, 22, 28	
5	ABNJB03043	Tule greater white-fronted goose	Anser albifrons gambelli	1	**13**	3	2	3	5	**5**	1	1	3	S3	No surveys during migration, management concern			G5	S3				x	x	x								19, 21, 22, 28	
5	ABNJB05010	Brant goose	Branta bernicla	1	**11**	3	2	3	3	**6**	2	2	2	S3				G5	S3	2,3	c	4,6	x	T	T							28, 29, 30	
5	ABNJB10110	Northern pintail	Anas acuta	1	**11**	3	2	3	3	**7**	2	2	3	S3				G5	S3				x	x	x		x		x	x		15, 19, 21, 22, 28, 30	
5	ABNJB11030	Redhead	Aythya americana	1	**11**	3	2	3	3	**7**	2	2	3	S3	Management concern			G5	S3				x						x	x		x	21, 22, 28, 29, 30	
5	ABNJB11060	Greater scaup	Aythya marila	1	**10**	4	0	3	3	**7**	2	2	3	S5	Management concern			G5	S5				x	x	x						x		21, 28, 30	
5	ABNJB11070	Lesser scaup	Aythya affinis	1	**10**	4	0	3	3	**7**	2	2	3	S4	Management concern			G5	S4				x	x	x		x			x	x		21, 22, 28	
5	ABNJB16010	Long-tailed duck	Clangula hyemalis	1	**11**	3	2	3	3	**7**	2	2	3	S3	Management concern			G5	S3				x	x	x								29, 30	
5	ABNJB17010	Black scoter	Melanitta nigra	1	**10**	3	0	3	4	**5**	1	2	2	S4	Management concern.			G5	S4					x	x								28, 29, 30, 31	
5	ABNJB17020	Surf scoter	Melanitta perspicillata	1	**13**	4	2	3	4	**5**	1	2	2	S3				G5	S3					T	x								28, 29, 30	
5	ABNJB17030	White-winged scoter	Melanitta fusca	1	**10**	4	0	3	3	**5**	1	2	2	S5	Management concern.			G5	S5						x								28, 29, 30	
5	ABNKC10010	Bald eagle	Haliaeetus leucocephalus	1	**13**	3	4	3	3	**7**	2	2	3	T		T	T	G4	S4	1	b,c	1,2,3,4,5,6			T	T	T	T	T	T	T	T	1-7, 19-23, 25, 27-30	SR 2001, RP 1990, MR 2003
5	ABNKC12060	Northern goshawk	Accipiter gentilis	1	**10**	3	3	2	2	**6**	2	2	2	C		C	Co	G5	S3	1	b	1,2,3,4,5,6			T	T	T	T	T	T	x	T	T	1, 3, 4, 5, 6, 7, 8, 13, 22-25	MR 2003
5	ABNKC19120	Ferruginous hawk	Buteo regalis	1	**15**	4	4	3	4	**5**	3	1	1	T		T	Co	G4	S2	1	b	1,2,3										T	14, 15, 16, 17, 18, 19	RP 1996, MR 2003
5	ABNKC22010	Golden eagle	Aquila chrysaetos	1	**12**	3	3	3	3	**6**	3	1	2	C		C		G5	S3	1	b	1,2,3,4,5,6		x	x	T	T	T	T	x	x	x	7, 13, 14, 15, 16, 17, 19, 25	MR 2003
5	ABNKD06070	Peregrine falcon	Falco peregrinus	1	**11**	2	3	3	3	**7**	2	2	3	S		S	Co	G4	S2	1	b	1,2,3,4,5,6		T	T	T	T	T	T	x	T	T	1-16, 20-30	SR 2002, MR 2003
5	ABNKD06090	Prairie falcon	Falco mexicanus	1	**10**	3	1	3	3	**5**	2	1	2	M		M		G5	S3	3	b	1,2,3,5							T	x	x		13, 15, 16, 18, 19	MR 2003

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5	ABNLC12010	Greater sage-grouse	Centrocercus urophasianus	1	**17**	5	4	3	5	**6**	3	1	2	T		T	C	G4	S1	1,3	b,c	1,2,3									T	15, 16, 17, 18, 19	SR 2003;1998, RP 2004, MR 2003
5	ABNLC13030	Sharp-tailed grouse	Tympanuchus phasianellus	1	**17**	5	4	3	5	**5**	2	1	2	T		T	Co	G4	S2	1,3	b,c	1,2						T			T	7, 8, 15, 16, 17, 19, 25	SR 1998, RP 1995, MR 2003
5	ABNLC24010	Mountain quai	Oreortyx pictus	1	**14**	3	4	3	4	**4**	1	1	2	S1				G5	S1	3	a	1,3,4,5,6	x				x			T		1, 2, 3, 4, 5, 7, 12, 14, 23, 25	SR 1993, RP 1993, MR 2003
5	ABNMK01010	Sandhill crane (greater)	Grus canadensis	1	**17**	4	5	3	5	**7**	3	2	2	E	Disjunct?	E			S1	1	b,c	1,2,3,4,5,6					x	T			x	15, 19, 22, 25	RP 2002, MR 2003
5	ABNNB03031	Snowy plover	Charadrius alexandrinus nivosus	1	**16**	5	4	2	5	**6**	2	2	2	T		E	T	G4	S1	1	b	6		T								18, 21, 26, 28	RP 1995;2001fed, MR 2003
5	ABNNC01020	Black oystercatcher	Haematopus bachmani	1	**10**	3	1	3	3	**6**	2	1	3	M		M		G5	S4					T	x							26, 27	MR 2003
5	ABNNF02010	Willet	Catoptrophorus semipalmatus	1	**11**	3	2	2	4	**6**	2	1	3	S3	Extremely limited range.			G5	S3	2	b	1,2,3,4,5,6		x								16, 17, 18, 19, 21, 22, 28	
5	ABNNF06010	Upland sandpiper	Bartramia longicauda	1	**15**	5	5	2	3	**4**	2	1	1	E	Peripheral species.	E		G5	SH	1	a	1									x	15, 22	RP 1995;1998 fed, MR 2003
5	ABNNF08040	Marbled godwit	Limosa fedoa	1	**12**	2	2	3	5	**5**	2	1	2	S3	Extremely limited range. WA subspecies breeds in AK.			G5	S3	2	b	1,2,3,4,5,6		x	x						x	18, 21, 26, 28	
5	ABNNF11020	Red knot	Calidris canutus	1	**13**	4	2	3	4	**4**	1	1	2	S3				G5	S3					x	x							19, 26, 28	
5	ABNNF11160	Rock sandpiper	Calidris ptilocnemis	1	**12**	3	2	3	4	**4**	1	1	2	S3				G5	S3					T	x							26, 27	
5	ABNNM08080	Arctic tern	Sterna paradisaea	1	**11**	4	1	2	4	**7**	3	1	3	M		M		G5	S2					x	x							26, 27, 30, 31, 32	
5	ABNNN02010	Common murre	Uria aalge	1	**10**	3	3	1	3	**7**	2	2	3	C		C		G5	S4	1,2	b,c	4,6		T	x							27, 28, 29, 30, 31	MR 2003
5	ABNNN06010	Marbled murrelet	Brachyramphus marmoratus	1	**16**	5	4	2	5	**6**	3	1	2	T	East Cascades peripheral	T	T	G3	S3	1,2	a,b,c	4,5,6		T	T	T	T					1, 3, 28, 29, 30, 31	SR 1993, RP 1997;1997 fed, MR
5	ABNNN07030	Ancient murrelet	Synthliboramphus antiquus	1	**10**	3	2	2	3	**6**	1	2	3	S3	Breeder?			G4	S3					T	x							29, 30, 31	
5	ABNNN08010	Cassin's auklet	Ptychoramphus aleuticus	1	**12**	3	3	2	4	**6**	1	2	3	C		C	Co	G4	S3	1,2	b	6		T	x							27, 30, 31, 32	
5	ABNNN12010	Tufted puffin	Fratercula cirrhata	1	**13**	3	3	3	4	**7**	2	2	3	C		C	Co	G5	S3	1,2,3	b,c	4,6		T	x							27, 29, 30, 31, 32	
5	ABNRB02020	Yellow-billed cuckoo	Coccyzus americanus	1	**15**	5	3	2	5	**3**	1	1	1	C	Extirpated?	C	C	G5	SH	1	a	1,2,4			T		T					23, 25	MR 1991
5	ABNSB01020	Flammulated owl	Otus flammeolus	1	**13**	4	3	2	4	**4**	1	1	2	C		C		G4	S3	1	b,c	1,2,3					T	T	T	T	x	3, 5, 6, 7, 25	MR 2003
5	ABNSB10010	Burrowing owl	Athene cunicularia	1	**14**	4	3	3	4	**4**	2	1	1	C		C	Co	G4	S2	1	b,c	1,2,3,5						T		x	T	11, 15, 16, 17, 18, 19, 22	SR 2004d, MR 2003
5	ABNSB12011	Northern spotted owl	Strix occidentalis caurina	1	**18**	5	5	3	5	**6**	3	2	1	E		E	T	G3	S1	1	a	2,3,4,5,6		T	T	T	T	T				1, 3, 4, 5, 7	RP 1992 fed, MR 1991, SR 2004
5	ABNSB12040	Great gray owl	Strix nebulosa	1	**10**	3	1	2	4	**5**	2	1	2	M		M		G5	S2									T		x		3, 5, 6, 7, 22, 24	
5	ABNUA03020	Vaux's swift	Chaetura vauxi	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G5	S3	1	b	1,2,3,4,5,6		T	T	T	T	T	T	x	T	x	1, 4, 5, 20, 21, 23, 24	MR 2003
5	ABNYF04010	Lewis' woodpecker	Melanerpes lewis	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G4	S3	1	b	1,2,3,5					T	T	T	T	T	2, 3, 5, 7, 11, 19, 25	MR 2003
5	ABNYF04050	Acorn woodpecker	Melanerpes formicivorus	1	**13**	3	4	2	4	**5**	2	1	2	S1	Peripheral species.	M		G5	S1								x					2, 7, 11, 20	
5	ABNYF07070	White-headed woodpecker	Picoides albolarvatus	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G4	S2	1	b,c	1,2,3,5					T	T		T	x	5, 7	MR 2003
5	ABNYF07090	Black-backed woodpecker	Picoides arcticus	1	**12**	3	3	2	4	**4**	2	1	1	C		C		G5	S3	1	b,c	1,2,3,5					T	T	x	T		3, 4, 5, 6, 7, 9, 24	MR 2003
5	ABNYF12020	Pileated woodpecker	Dryocopus pileatus	1	**12**	3	3	2	4	**6**	2	2	2	C		C		G5	S4	1	b	1,2,3,4,5,6	x	x	x	T	T	x	x	x	x	1, 3, 4, 5, 7, 20, 23, 24, 25	MR 2003
5	ABPAT0201L	Streaked horned lark	Eremophila alpestris strigata	1	**16**	5	4	2	5	**4**	1	1	2	S1		C	C	G5	S1	1	a	4,5,6		T	T							9, 10, 11, 15, 16, 17, 18, 19, 20, 26	SR 2005
5	ABPAU01010	Purple martin	Progne subis	1	**13**	4	3	2	4	**5**	2	1	2	C		C		G5	S3	1	b	4,5,6		T	T							1, 2, 3, 26, 27, 28	MR 2003
5	ABPAZ01021	Slender-billed white-breasted nuthatch	Sitta carolinensis aculeata	1	**16**	5	4	2	5	**3**	1	1	1	S1		C	Co	G5	S1	1	a	5,6			T		x					2, 3, 7, 11, 20, 23, 25	
5	ABPAZ01030	Pygmy nuthatch	Sitta pygmaea	1	**10**	4	2	1	3	**4**	1	1	2	S3				G5	S3									x	T	x	T	7, 25	
5	ABPBJ15020	Western bluebird (W WA)	Sialia mexicana	1	**11**	3	1	3	4	**6**	2	1	3	M		M		G5	S3					T	T		x					1-7, 11, 13, 15, 19, 20, 25	MR 1991
5	ABPBK04010	Sage thrasher	Oreoscoptes montanus	1	**13**	4	3	2	4	**4**	1	1	2	C		C		G5	S3	1	b,c	1,2,3,5						T			x	16, 17, 18	MR 2003
5	ABPBR01030	Loggerhead shrike	Lanius ludovicianus	1	**11**	3	3	2	3	**5**	2	1	2	C		C	Co	G4	S3	1	b,c	1,2,3,5						x			T	11, 13, 15, 16, 17, 18, 19	MR 2003
5	ABPBX95011	Oregon vesper sparrow	Pooecetes gramineus affinis	1	**15**	4	4	2	5	**4**	2	1	1	S1	Grasslands, prairie	C	Co	G5	S1	1	a	4,5,6			T							3, 9, 11, 13, 15, 16, 17, 19	
5	ABPBX97020	Sage sparrow	Amphispiza belli	1	**12**	4	3	1	4	**4**	2	1	1	C		C		G5	S3	1	b,c	1,2,3						x			T	13, 16, 17	MR 2003
4	ARAAD02031	Western pond turtle	Actinemys (Clemmys) marmorata	1	**17**	5	5	2	5	**6**	2	1	3	E	West Cascades, East Cascades (disjunct?)	E	Co	G3	S1	1	a	4,5,6			T		T	x				2, 3, 7, 11, 12, 21, 22, 23	SR 1993, RP 1999, MR 1997
4	ARACF12030	Pygmy horned lizard	Phrynosoma douglasi	1	**11**	4	2	1	4	**5**	1	2	2	S3				G5	S3									x		x	T	6, 7, 13, 15, 16, 17, 20	
4	ARACF14030	Sagebrush lizard	Sceloporus graciosus	1	**11**	4	3	1	3	**5**	2	1	2	C		C	Co	G5	S2	1	a	1,2,3						T		x	x	3, 6, 7, 12-18, 20	
4	ARADB07010	Racer (W WA)	Coluber constrictor	1	**10**	5	0	1	4	**3**	1	1	1	S5				G5	S5						T		x					2, 5, 6, 7, 11, 13-20, 25	
4	ARADB09010	Sharptail snake	Contia tenuis	1	**12**	5	3	1	3	**3**	1	1	1	C	Disjunct?	C		G5	S2	1	a	2,3,5,6			T			x			x	1, 2, 3, 7, 11, 19, 20, 23, 25	
4	ARADB19060	California mountain kingsnake	Lampropeltis zonata	1	**12**	4	4	1	3	**4**	1	1	2	S1	Disjunct?	C		G4	S1	1	a	5				T	x					7, 11, 12	MR 1997
4	ARADB21040	Striped whipsnake	Masticophis taeniatus	1	**14**	4	4	1	5	**3**	1	1	1	S1	Peripheral, historical?	C		G5	S1	1	a	1,2,3									T	3, 7, 12, 13, 16, 17, 18	MR 1997
4	ARADB26021	Pacific gopher snake (W WA)	Pituophis catenifer catenifer	1	**11**	5	1	1	4	**3**	1	1	1	M		M		G5	S5						T							2, 5, 6, 7, 11, 14-20, 25	
3	AAAAA01140	Tiger salamander	Ambystoma tigrinum	1	**13**	5	1	2	5	**6**	3	1	2	M		M		G5	S3									T		x		7, 15, 16, 17, 19-22, 25	
3	AAAAD12040	Dunn's salamander	Plethodon dunn	1	**10**	3	3	1	3	**6**	2	2	2	C		C		G4	S2	1	a	5,6		T								1, 4, 23	MR 1997
3	AAAAD12100	Larch Mountain salamander	Plethodon larsell	1	**10**	3	3	1	3	**5**	1	2	2	S		S	Co	G3	S3	1	a	3,4,5			T	x	T	T				1, 4	SR 1993, MR 1997
3	AAAAD12190	Van Dyke's salamander	Plethodon vandyke	1	**16**	5	3	3	5	**6**	1	2	3	C		C	Co	G3	S3	1	a	5,6		T	T		T					1, 4, 23	MR 1997
3	AAAAJ01030	Cascade torrent salamander	Rhyacotriton cascadae	1	**10**	3	3	1	3	**5**	1	2	2	C		C		G3	S3	1	a	5,6			T		T					1, 4, 23	MR 1997
3	AAAAJ01040	Columbia torrent salamander	Rhyacotriton kezeri	1	**10**	3	3	1	3	**5**	1	2	2	C		C	Co	G3	S3	1	a	5,6		T	T							1, 4, 23	MR 1997
3	AAABA01020	Rocky Mountain tailed frog	Ascaphus montanus	1	**12**	4	3	2	3	**4**	1	1	2	C		C		G4	SU	1	a	1								T		1, 4, 5, 23, 25	
3	AAABB01030	Western toad	Bufo boreas	1	**13**	4	3	2	4	**6**	3	1	2	C		C	Co	G4	S3	1	a	1,2,3,4,5,6		T	T	x	T	T	T	T	T	1-18, 21, 22, 23, 24, 25	
3	AAABH01170	Northern leopard frog	Rana pipiens	1	**18**	5	5	3	5	**5**	2	1	2	E		E	Co	G5	S1	1	a	1,2,3,5						T	x		T	7, 15, 16, 17, 21, 22, 25	SR 1999, MR 1997
3	AAABH01180	Oregon spotted frog	Rana pretiosa	1	**18**	5	5	3	5	**6**	2	1	3	E		E	C	G2	S1	1	a	5,6			T	x		x				2, 5, 7, 11, 21, 22, 23	SR 1997, RP 1998, MR 1997

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3	AAABH01290	Columbia spotted frog	Rana luteiventris	1	**14**	4	3	2	5	**5**	2	1	2	C		C	Co	G4	S4	1	a	1,2,3,4				x		T	T	x	x	T	4-9, 13, 14, 15, 16, 21, 22, 24, 25	MR 1997
2	AFBAA02030	River lamprey	Lampetra ayresi	1	**13**	4	3	2	4	**5**	3	1	1	C	Possibly declining.	C	Co	G4	S2	1	a	4,5,6		T	x	x	T	T			T	x	21, 29, 31	
2	AFBAA02100	Pacific lamprey	Lampetra tridentata	1	**13**	4	2	3	4	**7**	2	2	3	S3			Co	G5	S3					T	T	x	T	T			x	T	21, 29, 31, 32?	
2	AFC4A06100	Copper rockfish	Sebastes caurinus	1	**14**	4	3	3	4	**6**	2	2	2	C	Live to at least 50 years	C	Co			1,2,3	c	4,6		x	T									SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06180	Greenstriped rockfish	Sebastes elongatus	1	**10**	3	3	1	3	**6**	1	1	4	C	Live to be 54 years old.	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06330	Quillback rockfish	Sebastes maliger	1	**14**	4	3	3	4	**7**	2	1	4	C	Old geezers (95 y)	C	Co			1,2,3	c	4,6		x	T									SR 1997, MR 1998(PS);2003 (coastal)
2	AFC4A06350	Black rockfish (Puget Sound)	Sebastes melanops	1	**12**	3	3	3	3	**7**	2	2	3	C		C				1,2,3	c	4,6			T									SR 1997, MR 1998 (PS);2003, SR 1999
2	AFC4A06410	China rockfish	Sebastes nebulosus	1	**12**	3	3	3	3	**4**	1	1	2	C	Live to be 79 years old	C				1,2,3	a	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06420	Tiger rockfish	Sebastes nigrocinctus	1	**12**	2	3	3	4	**6**	1	1	4	C	Live to be 115 years old.	C				1,2,3	a	4,6		x	T									SR 1997 (PS), MR 2003 (coastal)
2	AFC4A06440	Bocaccio rockfish	Sebastes paucispinis	1	**13**	4	3	3	3	**5**	1	1	3	C	Live to be 50 years	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06460	Canary rockfish	Sebastes pinniger	1	**14**	4	3	3	4	**6**	2	1	3	C	Live to be 84 years old	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003, SR 2001
2	AFC4A06480	Redstripe rockfish	Sebastes proriger	1	**10**	3	3	1	3	**6**	1	1	4	C	Live to be 55 years old	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06530	Yelloweye rockfish	Sebastes ruberrimus	1	**16**	5	3	3	5	**6**	2	1	3	C	Live to be 118 years old, fer chrissakes!!!	C				1,2,3	a	4,6		x	T									MR 1997, MR 1998 (PS);2003, SR 2002
2	AFC4E02170	Margined sculpin	Cottus marginatus	1	**11**	3	3	2	3	**5**	1	1	3	S		S	Co	G3	S1	1	a	1									T	T	21	SR 1998
2	AFCAA01030	Green sturgeon	Acipenser medirostris	1	**14**	4	3	3	4	**7**	2	1	4	S2				G3	S2	2,3	a	4,5,6		T	x		x						21	
2	AFCFA07030	Pacific herring (Cherry Pt, Discovery Bay)	Clupea pallasi	1	**13**	4	3	3	3	**7**	2	1	4	C		C	C	GU	SU	1,2,3	b,c	4,6			T									MP 1998, SR 2004 (PS, coastal)
2	AFCHA02088	Westslope cutthroat	Oncorhynchus clarki lewis	1	**10**	3	0	3	4	**7**	2	1	4	G4			Co	G4		3	a	4,6						x	T	T	T	T	21, 28, 29, 30, 31, 32	
2	AFCHA02092	Inland redband trout	Oncorhynchus mykiss gairdner	1	**10**	3	0	3	4	**5**	1	1	3	G5				G5											x	T	x	T	21	
2	AFCHA03020	Pygmy whitefish	Prosopium coulteri	1	**13**	3	3	3	4	**4**	1	1	2	S	Found in only 9 lakes in WA.	S		G5	S1	1,2	a	1,2,3,4,5,6		T			x	x	T	x			21	SR 1998, MR 1991
2	AFCHA05023	Bull trout (Columbia Basin)	Salvelinus confluentus	1	**13**	3	4	2	4	**7**	2	2	3	T		C	T	G3	SU	1,2,3	a,c	1,2,3,4,5,6						T	T	x	T	T	21, 28, 29, 30, 31, 32	RP 2002 fed, MP 2000
2	AFCHA05024	Bull trout (Coastal/Puget Sound)	Salvelinus confluentus	1	**11**	2	4	3	2	**7**	2	2	3	T		C	T	G3	SU	1,2,3	a,c	1,2,3,4,5,6		T	T	x	T						21, 28, 29, 30, 31, 32	RP 2004 fed, MP 2000
2	AFCHB04010	Eulachon	Thaleichthys pacificus	1	**11**	3	3	3	2	**5**	2	1	2	C		C	C	G5	S4	1,2,3	c	4,5,6		x	x		x							MP 1998
2	AFCHD03010	Olympic mudminnow	Novumbra hubbsi	1	**12**	3	3	2	4	**5**	1	1	3	S		S		G3	S2	1	a	4,5,6		T	T								21, 23	SR 1999, MR 1991
2	AFCJB13030	Surfsmelt	Hypomesus pretiosus	1	**11**	4	0	3	4	**7**	2	1	4	G5				G5	SU	2,3	b,c	4,6		x	T									MP 1998
2	AFCJB37040	Leopard dace	Rhinichthys falcatus	1	**11**	3	3	2	3	**4**	1	2	1	C		C		G4	S2	1	a	1,2,3,5					x	T	T		x	x	21	
2	AFCJC02160	Mountain sucker	Catostomus platyrhynchus	1	**11**	3	3	2	3	**4**	1	1	2	C		C		G5	S2	1	a	1,2,3,5					T	T			x	T	21	MR 1991
2	AFCJC02260	Salish sucker	Catostomus sp. 4	1	**13**	4	4	2	3	**3**	1	1	1	S1		M		G1	S1						T	x	x						21	
2	AFCS601030	Pacific sand lance	Ammodytes hexapterus	1	**10**	4	0	3	3	**6**	2	1	3							2,3	b,c	4,6		x	T									MR 1998
1	IICOL02090	Columbia River tiger beetle	Cicindela columbica	1	**15**	5	4	1	5	**3**	1	1	1	S1	May be extirpated in WA.	C		G2	SH	1	a	1,2,3,5									x	x	25. Sandbars and sand dunes in riparian zones of large lowland rivers	
1	IICOL0210B	Siuslaw sand tiger beetle	Cicindela hirticollis siuslawensis	1	**11**	4	2	1	4	**3**	1	1	1	S3	Endemic to PNW coast.			G5	S3					T									26, 28	
1	IICOL4H010	Beller's ground beetle	Agonum belleri	1	**11**	4	3	1	3	**3**	1	1	1	C	Endemic to PNW. Inhabits sphagnum bogs.	C	Co	G3	S3	1	a	4			T	x							23. Margins of bogs with open water and mats of sphagnum	MR 1995
1	IICOL4J010	Long-horned leaf beetle	Donacia idola	1	**10**	3	3	1	3	**3**	1	1	1	C	Endemic to PNW. Known only from sphagnum bogs.	C		GU	SU	1	a	4			x	x							23. Sphagnum bogs.	MR 1995
1	IICOL4K010	Hatch's click beetle	Eanus hatchii	1	**11**	3	4	1	3	**3**	1	1	1	S1	Endemic to PNW. Known only from sphagnum bogs.	C	Co	G2	S1	1	a	4			T									MR 1995
1	IICOL4L110	Mann's mollusk-eating ground beetle	Scaphinotus mannii	1	**13**	4	3	1	5	**3**	1	1	1	C	A very vulnerable and possibly endangered species.	C				1	a	1									x	x	25. Confined to riparian strips of lowland tributaries of the Snake R.	
1	IILEP37050	Propertius' duskywing butterfly	Erynnis propertius	1	**11**	4	1	2	4	**5**	2	1	2	M	Western Washington only.	M		G5	S3						x	T	x	x					2, 11	
1	IILEP65209	Oregon branded skipper butterfly	Hesperia colorado oregonia	1	**10**	4	1	2	3	**4**	1	1	2	M		M		G5	S2						T								11 and 2/11 (ecotone)	
1	IILEP66030	Mardon skipper butterfly	Polites mardon	1	**15**	4	5	2	4	**5**	2	1	2	E		E	C	G2	S1	1	a	3,5,6			T		T	T					11, 2/11, 6, 7, 9, 15, 19, 22, 4/15, 5/15,	SR 1999, MR 1995
1	IILEP66092	Dog star skipper butterfly	Polites sonora siris	1	**10**	3	3	1	3	**3**	1	1	1	S2				G4	S2					x	T								11, 19, 22, 1/11, 2/11	
1	IILEP72040	Yuma skipper butterfly	Ochlodes yuma	1	**12**	3	4	1	4	**4**	1	1	2	S1		C		G5	S1	1	a	2										x	16, 21, 22	MR 1995
1	IILEP90021	Shepard's parnassian butterfly	Parnassius clodius shepard	1	**14**	4	4	2	4	**4**	2	1	1	S1		C		G5	S1	1	a	1									x	x	14, 25	MR 1995
1	IILEPA5011	Island marble butterfly	Euchloe ausonides insulanus	1	**15**	4	4	2	5	**5**	2	1	2	S1		C	Co	G5	S1	1	a	4			T								11, 19, 26, 27, 28	
1	IILEPC1152	Makah (Queen Charlotte) copper	Lycaena mariposa charlottensis	1	**12**	3	3	2	4	**4**	1	1	2	C		C	Co	G5	S2	1	a	6		T									22, 23	MR 1995
1	IILEPC8012	Chinquapin hairstreak butterfly	Habrodais grunus herri	1	**11**	3	4	1	3	**3**	1	1	1	S1		C		G4	S1	1	a	5					x	x					1, 2, 23	MR 1995
1	IILEPE2100	Johnson's hairstreak butterfly	Mitoura johnsoni	1	**12**	3	3	2	4	**3**	1	1	1	C		C		G2	S2	1	a	4,5,6		T	T	T	x						1, 2, 4	MR 1995
1	IILEPE2137	Juniper hairstreak butterfly	Mitoura grynea barry	1	**10**	3	3	1	3	**3**	1	1	1	C		C		G4	S2	1	a	1,2,5						x			T	x	7, 13	MR 1995
1	IILEPE2213	Hoary elfin butterfly (W WA)	Incisalia polia obscura	1	**10**	3	2	1	4	**4**	1	1	2	S3		M		G5	S3						x								2, 6, 7, 9, 11, 22, heath scrub	
1	IILEPG801G	Puget (Blackmore's) blue butterfly	Icaricia icarioides blackmorei	1	**11**	3	3	2	3	**5**	2	1	2	S2		C		G5	S2					T	T								9, 11, 1/11, 2/11, 4/11, 22/11 (ecotones)	MR 1995
1	IILEPJ6028	Puget Sound fritillary butterfly	Speyeria cybele pugetensis	1	**10**	3	2	2	3	**4**	2	1	1	S3	Heath scrub			G4	S3					x	T		x						2, 6, 9, 11, 19, 22, 23, 1/11, 4/11, heath	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	179	9.5	CRITERIA – Concerns				7.5	Actions									PHS				Ecoregions										
				SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	Criteria	Area	Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
1	IILEPJ6087	Oregon silverspot butterfly	Speyeria zerene hippolyta	1	**17**	5	5	2	5	**6**	2	2	2	E		E	T	G5	SX	1	a	6		T									19, 22, 26, 27, 26/6, 26/1, 26/2	SR 1993, RP1982;2001 fed, MR 1995
1	IILEPJ608A	Valley silverspot butterfly	Speyeria zerene bremneri	1	**13**	4	3	2	4	**4**	2	1	1	C		C	Co	G5	S2	1	a	4,5,6		T	T		x						2, 9, 11, 19, 22, 23, 1/11, 4/11	MR 1995
1	IILEPJ7030	Silver-bordered fritillary butterfly	Boloria selene atrocostalis	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G5	S3	1	a	1,2,3							T	x		T	19, 22, 24, 25	MR 1995
1	IILEPK405K	Taylor's checkerspot butterfly	Euphydryas editha taylori	1	**14**	4	4	2	4	**5**	2	1	2	S1		C	C	G5	S1	1	a	4,5,6			T		x						2, 11, 19, 23, 27, 28 and 2/11 (ecotone)	SR 2005, MR 1995
1	IILEPP1021	Great arctic butterfly	Oeneis nevadensis gigas	1	**12**	3	3	2	4	**3**	1	1	1	C		C		G5	SH	1	a	4			x								2, 11	
1	IILEYKP140	Sand-verbena moth	Copablepharon fuscum	1	**13**	4	4	1	4	**4**	2	1	1	S1					S1					T	x								26	
1	IIODO06020	White-belted ringtail dragonfly	Erpetogomphus compositus	1	**13**	4	4	2	3	**3**	1	1	1	S1				G5	S1													x	21	
1	IIODO08150	Columbia (Lynn's) clubtail dragonfly	Gomphus lynnae	1	**12**	3	4	2	3	**3**	1	1	1	S1			Co	G2	S1													x	21	
1	IIODO08330	Pacific clubtail dragonfly	Gomphus kurilis	1	**12**	3	4	2	3	**3**	1	1	1	S1				G4	S1						T		x						21	
1	IIODO14170	Subarctic darner dragonfly	Aeshna subarctica	1	**12**	3	3	2	4	**6**	1	1	4	S2				G5	S2										T				21, 22	
1	IIODO44010	Boreal whiteface dragonfly	Leucorrhinia borealis	1	**12**	3	4	2	3	**3**	1	1	1	S1	Peripheral species (CS).			G5	S1										T				21, 22, 24	
1	IIODO70020	Subarctic bluet dragonfly	Coenagrion interrogatum	1	**11**	3	3	2	3	**3**	1	1	1	S2				G5	S2										T				9, 10, 21, 22, 24	
1	IMBIV04020	California floater (bivalve)	Anodonta californiensis	1	**14**	4	4	2	4	**4**	1	1	2	S1		C	Co	G3	S1	1,2	a	1,2,3,5							T			T	21	MR 1995
1	IMBIV04090	Western floater (bivalve)	Anodonta kennerly	1	**10**	4	0	2	4	**4**	1	1	2	S4				G4	S4					T	x							x	21	
1	IMBIV04100	Winged floater (bivalve)	Anodonta nuttalliana	1	**11**	4	0	2	5	**4**	1	1	2	G3				G3	SU					x			x		x		x	x	21	
1	IMBIV04110	Oregon floater (bivalve)	Anodonta oregonensis	1	**10**	3	2	2	3	**4**	1	1	2	S3				G5	S3					T			x		T		x	x	21	
1	IMBIV19010	Western ridged mussel	Gonidea angulata	1	**14**	4	3	3	4	**4**	1	1	2	S2				G3	S2					T	T		x		T		x	x	21	
1	IMBIV27020	Western pearlshell (bivalve)	Margaritifera falcata	1	**10**	4	0	2	4	**4**	1	1	2	S4				G4	S4					T	x		x				x	x	21	
1	IMGAS62030	Bluegray taildropper (slug)	Prophysaon coeruleum	1	**10**	4	0	2	4	**3**	1	1	1	S4				G4	S4						x		x						1	
1	IMGAS80100	Crowned tightcoil (snail)	Pristiloma pilsbryi	1	**14**	4	4	1	5	**3**	1	1	1	S1				G1	S1					T									1	
1	IMGAS93030	Columbia oregonian	Cryptomastix hendersoni	1	**10**	4	0	1	5	**3**	1	1	1	G2	Found in talus, springs and seeps in the Columbia Gorge; extirpated from Skamania Co.			G2														x	14, 25	
1	IMGASB2020	Oregon megomphix (snail)	Megomphix hemphilli	1	**10**	4	0	2	4	**3**	1	1	1	G2				G2						T	T		x						1	
6	AMABA01170	Pacific water shrew	Sorex bendirii	0	**6**	2	1	1	2	**9**	1	3	5	M		M		G4	S4						T	T							1, 2, 4, 5, 22, 23, 24, 25	
6	AMABA01221	Destruction Island shrew	Sorex trowbridgii destruction	0	**10**	2	4	1	3	**9**	1	3	5	S1			Co	G5	S1					T		T							1, 19, 27	
6	AMABA01250	Pygmy shrew	Sorex hoyi	0	**6**	2	1	1	2	**9**	2	3	4	M		M		G5	S2														5	MR 1991
6	AMABB02010	Townsend's mole	Scapanus townsendi	0	**3**	1	0	1	1	**9**	1	3	5	S5				G5	S5						T	T							1, 9, 11, 19, 20, 22, 23, 27	
6	AMABB02011	Olympic snow mole	Scapanus townsendii olympicus	0	**3**	1	0	1	1	**9**	1	3	5	G5				G5						T									4, 9, 10, 24	
6	AMACC01020	Yuma myotis	Myotis yumanensis	0	**4**	1	0	1	2	**6**	2	2	2	S5			Co	G5	S5					T									1, 2, 4,-7, 9, 11, 13-16, 19-25, 28	
6	AMACC01070	Long-eared myotis	Myotis evotis	0	**6**	2	1	1	2	**6**	2	2	2	M		M	Co	G5	S4					T									1-7, 9, 13-18, 21-25	
6	AMACC01090	Fringed myotis	Myotis thysanodes	0	**8**	3	1	1	3	**6**	2	2	2	M		M	Co	G4	S3					T				T					1, 2, 3, 21	
6	AMACC01110	Long-legged myotis	Myotis volans	0	**6**	2	1	1	2	**5**	2	1	2	M		M	Co	G5	S3					T		T	T	T	T				1-9, 11, 14, 21, 22, 23, 25, 28	
6	AMACC01120	California myotis	Myotis californicus	0	**5**	2	0	1	2	**6**	2	2	2	S5				G5	S5														1, 2, 5, 6, 7, 8, 11, 14-17, 21-25, 28	
6	AMACC01140	Small-footed myotis	Myotis ciliolabrum	0	**6**	2	1	1	2	**6**	2	2	2	M	Peripheral	M	Co	G5	S4														13, 14, 15, 16, 17, 21, 25	
6	AMACC03010	Western pipistrelle	Pipistrellus hesperus	0	**6**	2	1	1	2	**5**	1	2	2	M		M		G5	S3														14, 15, 16, 17, 18, 21, 25	
6	AMACC04010	Big brown bat	Eptesicus fuscus	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5	2	b,c	1,2,3,4,5,6											1, 2, 4, 5, 6, 7, 11, 13, 14, 19-25, 27, 28	
6	AMACC05030	Hoary bat	Lasiurus cinereus	0	**4**	1	1	1	1	**6**	2	2	2	M		M		G5	S5														1, 2, 4, 5, 6, 7, 20, 21	
6	AMACC07010	Spotted bat	Euderma maculatum	0	**9**	3	1	2	3	**7**	2	2	3	M	Peripheral	M		G4	S3								T		T			T	7, 14, 15, 16, 18, 19, 21, 22, 25	
6	AMACC10010	Pallid bat	Antrozous pallidus	0	**6**	2	1	1	2	**5**	2	2	1	M		M		G5	S3	2	b,c	1,2,3,4,5,6							T			T	3, 7, 13-19, 21, 22, 25	
6	AMAEA01020	Pika	Ochotona princeps	0	**9**	3	0	2	4	**4**	1	1	2	S5				G5	S5														9,10	
6	AMAEB03010	Snowshoe hare	Lepus americanus	0	**6**	2	0	2	2	**10**	3	3	4	S5				G5	S5				x										1, 2, 4, 5, 6, 8, 9, 23, 24, 25	
6	AMAFB02020	Least chipmunk	Tamias minimus	0	**6**	3	0	1	2	**6**	1	2	3	S4	Shrub-steppe obligate.			G5	S4														8, 16, 17, 18	
6	AMAFB02031	Olympic yellow-pine chipmunk	Tamias amoenus caurinus	0	**7**	2	0	2	3	**8**	1	2	5	G5				G5						T									4, 9, 10	
6	AMAFB02130	Red-tailed chipmunk	Tamias ruficaudus	0	**6**	1	1	2	2	**7**	1	3	3	M		M		G5	S2														5	
6	AMAFB03020	Yellow-bellied marmot	Marmota flaviventris	0	**6**	2	0	2	2	**9**	3	2	4	S4				G5	S4				x										7, 9, 10, 13, 14-20, 25	
6	AMAFB09020	Northern flying squirrel	Glaucomys sabrinus	0	**5**	2	0	1	2	**10**	3	3	4	S4				G5	S4														1, 2, 4, 5, 6, 7, 23, 24, 25	
6	AMAFC01042	White Salmon pocket gopher	Thomomys talpoides limosus	0	**6**	2	1	1	2	**6**	1	2	3	M		M		G5	S3														5, 7, 15, 16, 19	
6	AMAFD01070	Great Basin pocket mouse	Perognathus parvus	0	**3**	1	0	1	1	**10**	2	3	5	S5				G5	S5										T				13, 15, 16, 17, 18	
6	AMAFD03010	Ord's kangaroo rat	Dipodomys ordii	0	**7**	2	1	1	3	**8**	2	3	3	M		M		G5	S4														16, 17	
6	AMAFE01010	American beaver	Castor canadensis	0	**5**	2	0	2	1	**10**	3	3	4	S5				G5	S5				x										1, 2, 4, 5, 6, 7, 21, 22, 23, 24, 25	
6	AMAFF02030	Western harvest mouse	Reithrodontomys megalotis	0	**3**	1	0	1	1	**11**	3	3	5	S4				G5	S4										T				15, 16, 19, 22, 25	
6	AMAFF06010	Northern grasshopper mouse	Onychomys leucogaster	0	**4**	1	1	1	1	**10**	2	3	5	M		M		G5	S4													T	16, 17, 18	
6	AMAFF13010	Sagebrush vole	Lemmiscus curtatus	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3													T	15, 16, 17	
6	AMAFF15010	Muskrat	Ondatra zibethicus	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										19, 21, 22, 23, 25	
6	AMAFF17020	Northern bog lemming	Synaptomys borealis	0	**8**	3	1	1	3	**6**	1	2	3	M		M		G4	S3							T							5, 6, 9, 22, 24	
6	AMAFJ01010	Porcupine	Erethizon dorsatum	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 4, 5, 6, 7, 8, 9, 13, 14, 23, 24, 25	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	Criteria	Area	Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
				179	9.5	CRITERIA: Concerns				7.5	Actions									PHS				Ecoregions										
6	AMAGC01010	Sperm whale	Physeter macrocephalus	0	**12**	3	5	1	3	**10**	3	3	4	E	Pelagic, peripheral.	E	E	G3	SZ														32	
6	AMAGF02010	Dall's porpoise	Phocoenoides dall	0	**5**	1	1	2	1	**8**	3	2	3	M		M		G4	SU	2	c	4,6											29, 31, 32	
6	AMAGG01010	Gray whale	Eschrichtius robustus	0	**11**	2	3	3	3	**10**	3	3	4	S		S		G3	SZ	1,2	a	4,6			T								28, 30, 31	SR 1997
6	AMAGH01010	Fin whale	Balaenoptera physalus	0	**14**	3	5	1	5	**9**	3	3	3	E		E	E	G3	SZ														30, 31, 32	
6	AMAGH01020	Sei whale	Balaenoptera borealis	0	**12**	2	5	2	3	**10**	2	3	5	E		E	E	G3	SZ														28, 30, 31	RP F
6	AMAGH01030	Minke whale	Balaena acutorostrata	0	**9**	3	0	3	3	**7**	2	3	2	G5				G5	SZ						T								30, 31, 32	
6	AMAGH01040	Blue whale	Balaenoptera musculus	0	**14**	3	5	1	5	**9**	3	3	3	E		E	E	G3	SZ														30, 31, 32	
6	AMAGH02010	Humpback whale	Megaptera novaeangliae	0	**14**	3	5	3	3	**8**	3	2	3	E		E	E	G3	SZ						T								31, 32	
6	AMAGJ02010	Black right whale	Balaena glacialis	0	**16**	5	5	1	5	**9**	1	3	5	E		E	E		SU														30, 31, 32	
6	AMAJA01010	Coyote	Canis latrans	0	**4**	1	0	2	1	**9**	3	3	3	S5				G5	S5				x										1, 2, 4-20, 22, 23, 24, 25	
6	AMAJA03010	Red fox	Vulpes vulpes	0	**6**	2	0	2	2	**8**	2	2	4	S5				G5	S5				x										9, 10. 11, 19, 20, 27	
6	AMAJB01010	Black bear	Ursus americanus	0	**4**	1	0	2	1	**5**	3	1	1	S5				G5	S5				x										1, 2, 4,-10, 14, 19, 20, 22, 23, 24, 25	
6	AMAJC04010	California sea lion	Zalophus californianus	0	**4**	1	0	2	1	**11**	3	3	5	G5				G5	SU	2	c	4,6											28, 29, 30, 31	
6	AMAJE02010	Raccoon	Procyon lotor	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 11, 19, 20-28	
6	AMAJF01010	Marten (Cascade population)	Martes americana	0	**6**	2	0	2	2	**9**	3	2	4	S4				G5	S4	3	c	1,2,3,4,5,6	x				T	T					1, 4, 5, 6, 9, 24	MR 1991
6	AMAJF02010	Ermine	Mustela erminea anguinae	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x	T									1, 4, 5, 15, 19	
6	AMAJF02030	Long-tailed weasel	Mustela frenata	0	**3**	1	0	1	1	**10**	2	3	5	S5				G5	S5				x										1, 2, 4,-20, 22, 23, 24, 25, 26, 27	
6	AMAJF02050	Mink	Mustela vison	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5	3	c	1,2,3,4,5,6	x										1, 21, 22, 23, 24, 25, 26, 27, 28	
6	AMAJF05020	Western spotted skunk	Spilogale gracilis	0	**7**	3	0	1	3	**7**	2	2	3	S4				G5	S4				x										1, 4, 5	
6	AMAJF06010	Striped skunk	Mephitis mephitis	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 11, 12, 19, 22, 23, 25, 26, 27	
6	AMAJF10010	River otter	Lontra canadensis	0	**7**	2	0	3	2	**10**	3	3	4	S4				G5	S4				x			T							21, 22, 23, 25, 26, 28, 30	
6	AMAJG01010	Harbor seal	Phoca vitulina	0	**7**	1	1	2	3	**10**	3	2	5	M		M		G5	S4	2	c	4,5,6			T								26, 27, 28, 29, 30, 31	
6	AMAJH03020	Bobcat	Lynx rufus	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 4-8, 11-18, 20, 22-25, 27	
6	AMAJH04010	Cougar	Puma concolor	0	**6**	2	0	3	1	**9**	2	2	5	S4				G5	S4				x										1, 2, 4,-9, 12, 13, 14, 22-25	
6	AMALC02010	Columbian black-tailed deer	Odocoileus hemionus columbianus	0	**5**	1	0	3	1	**11**	3	3	5	S5				G5	S5	3	c	3,4,5,6	x										1, 2, 4-7, 9-12, 19, 20, 22-27	
6	AMALC02010	Rocky Mountain mule deer	Odocoileus hemionus hemionus	0	**9**	3	0	3	3	**9**	3	3	3	S5				G5	S5	3	b,c	1,2,3,5	x										4-10, 13-20, 22, 24, 25	
6	AMALC02020	Northwest white-tailed deer	Odocoileus virginianus ochrourus	0	**5**	1	0	3	1	**11**	3	3	5	S5				G5	S5	3	b,c	1,2	x										4, 5, 7, 8, 14, 15, 19, 22, 2 5	
6	AMALC03010	Moose	Alces alces	0	**5**	1	0	3	1	**8**	2	3	3	S5				G5	S5	3	c	1,2	x										4, 5, 8, 21, 22, 24, 25	
6	AMALCO1012	Rocky Mountain elk	Cervus elaphus nelson	0	**6**	2	0	3	1	**9**	3	3	3	S5				G5	S5	3	b,c	1,3,5,6	x				T	T			T		1, 4-9, 13-17, 19, 22, 23, 24, 25	
6	AMALCO1013	Roosevelt elk	Cervus elaphus roosevelti	0	**6**	2	0	3	1	**9**	3	3	3	S5				G5	S5	3	b,c	4,5,6	x			T	T	T					1, 2, 4, 9, 11, 12, 19, 22, 23, 24, 27	
6	AMALE02010	Mountain goat	Oreamnos americanus	0	**12**	3	3	3	3	**8**	2	2	4	S2				G5	S2	3	b,c	1,2,3,4,5,6	x			T	T	T	T				4, 9, 10	RP 1997, MR 1991
6	AMALE04010	Bighorn sheep	Ovis canadensis	0	**13**	4	2	3	4	**8**	3	2	3	S3			Co	G4	S3	3	b,c	1,2,3	x					T	T		T	T	13, 14, 15, 16, 17	
5	ABNCA03010	Horned grebe	Podiceps auritus	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G	S3														21, 22, 28, 30	
5	ABNCA03020	Red-necked grebe	Podiceps grisegena	0	**9**	3	1	2	3	**6**	2	1	3	M	Peripheral species -- JA	M		G5	S3						T								21, 22, 28, 29, 30, 31	
5	ABNCA03030	Eared grebe	Podiceps nigricollis	0	**9**	2	3	2	2	**6**	2	1	3	S2				G5	S2														21, 22	
5	ABNCA04020	Clark's grebe	Aechmophorus clarkii	0	**9**	3	1	1	4	**4**	1	1	2	M		M		G5	S2						T								21, 22, 28, 29, 30, 31	
5	ABNDA01020	Short-tailed albatross	Phoebastria albatrus	0	**7**	2	0	2	3	**6**	2	1	3	G1	Pelagic/peripheral.	C	E	G1	SA	1	a	6											31, 32	
5	ABNDC04010	Fork-tailed storm petrel	Oceanodroma furcata	0	**9**	2	2	2	3	**3**	1	1	1	S3				G5	S3					T									27, 31, 32	
5	ABNDC04020	Leach's storm petrel	Oceanodroma leucorhoa	0	**8**	3	0	2	3	**3**	1	1	1	S4				G5	S4					T									27, 31, 32	
5	ABNFC01020	Brown pelican	Pelecanus occidentalis	0	**12**	2	5	3	2	**9**	3	1	5	E	Peripheral species - JA.	E	E	G4	S3	1,2	c	6		T									20, 26, 27, 28, 30	RP 1983f
5	ABNFD01020	Double-crested cormorant	Phalacrocorax auritus	0	**4**	1	0	2	1	**6**	3	2	1	S4				G5	S4					T		T							20, 21, 22, 25, 26, 27, 28, 29, 30	
5	ABNFD01040	Brandt's cormorant	Phalacrocorax penicillatus	0	**9**	2	3	2	2	**4**	2	1	1	C		C		G5	S3	1,2	b,c	4,5,6		T							T		27, 28, 29, 30, 31	
5	ABNFD01050	Pelagic cormorant	Phalacrocorax pelagicus	0	**6**	2	0	2	2	**4**	2	1	1	S4				G5	S4					T									27, 28, 29, 30, 31	
5	ABNGA01020	American bittern	Botaurus lentiginosis	0	**7**	2	2	1	2	**6**	2	1	3	S3				G4	S3										T				19, 22, 28. Uses wet meadows.	
5	ABNGA04040	Great egret	Ardea alba	0	**8**	2	1	3	2	**7**	3	1	3	M	Peripheral species.	M		G5	S3														11, 18, 19, 21, 22, 23, 25, 28	
5	ABNGA08010	Green heron	Butorides virescens	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G5	S3														21, 22, 23, 28	
5	ABNGA11010	Black-crowned night heron	Nycticorax nycticorax	0	**7**	2	1	2	2	**7**	3	1	3	M		M		G5	S3	2	b	1,2,3,4,5,6											21, 22, 23, 25	
5	ABNJB02010	Tundra swan	Cygnus columbianus	0	**9**	3	0	3	3	**7**	2	2	3	S4				G5	S4	2,3	c	1,2,3,4,5,6	x										19, 21, 22, 28	
5	ABNJB03040	Pacific greater white-fronted goose	Anser albifrons	0	**7**	1	2	3	1	**9**	3	3	3	S3				G5	S3				x										19, 21, 22, 28	
5	ABNJB04010	Snow goose (lesser, Wrangel Island)	Chen caerulescens	0	**14**	4	2	3	5	**10**	3	3	4	S3	Look at this population only -- very vulnerable.			G5	S3	2,3	c	4	x		T								19, 21, 22, 28	
5	ABNJB05030	Western Canada goose	Branta canadensis	0	**5**	1	0	3	1	**7**	3	2	2	S5				G5					x											
5	ABNJB05032	Vancouver Canada goose	Branta canadensis fulva	0	**9**	3	0	3	3	**6**	1	2	3										x											
5	ABNJB05033	Lesser Canada goose	Branta canadensis parvipes	0	**8**	3	0	3	2	**9**	2	3	4										x										15, 16, 17, 19, 21, 22, 28	
5	ABNJB05034	Taverner Canada goose	Branta canadensis taverneri	0	**8**	3	0	3	2	**9**	2	3	4										x										15, 16, 17, 19, 21, 22, 28	
5	ABNJB05035	Aleutian Canada goose	Branta canadensis leucopareia	0	**11**	2	4	3	2	**10**	3	3	4	T		T	Co	G5	SZ	1	c	5,6	x		T								15, 16, 17, 19, 21, 22, 28	SR 1997, RP 1997f
5	ABNJB05037	Cackling Canada goose	Branta canadensis minima	0	**9**	4	0	3	2	**9**	2	3	4	G5				G5					x										15, 16, 17, 19, 21, 22, 28	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABNJB05039	Dusky Canada goose	Branta canadensis occidentalis	0	**9**	4	0	3	2	**8**	1	3	4	G5				G5					x		T								15, 16, 17, 19, 21, 22, 28	
5	ABNJB09010	Wood duck	Aix sponsa	0	**10**	2	2	3	3	**8**	2	3	3	S3				G5	S3	3	b	1,2,3,4,5,6											19, 21, 23, 25	
5	ABNJB10010	Green-winged teal	Anas crecca	0	**6**	2	0	3	1	**8**	2	3	3	S4				G5	S4														15, 19, 21, 22, 23, 25, 28	
5	ABNJB10060	Mallard	Anas platyrhynchos	0	**7**	3	0	3	1	**9**	3	3	3	S5				G5	S5				x										15, 16, 19, 20, 21, 22, 23, 25, 28, 30	
5	ABNJB10140	Cinnamon teal	Anas cyanoptera	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										19, 21, 22	
5	ABNJB10150	Northern shoveler	Anas clypeata	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										11, 15, 19, 21, 22	
5	ABNJB10160	Gadwall	Anas strepera	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										15, 19, 21, 22, 28	
5	ABNJB10180	American wigeon	Anas americana	0	**6**	2	0	3	1	**7**	2	2	3	S4				G5	S4														15, 19, 21, 22, 23, 28, 30	
5	ABNJB11020	Canvasback	Aythya valisinaria	0	**9**	3	0	3	3	**7**	2	2	3	S4	Management concern			G5	S4				x										21, 22, 28, 29, 30	
5	ABNJB15010	Harlequin duck	Histrionicus histrionicus	0	**12**	3	3	3	3	**8**	3	2	3	S2			Co	G4	S2	2,3	b,c	1,2,3,4,5,6	x	T		T	T	T					21, 23, 25, 28, 30	MR 2003
5	ABNJB18010	Common goldeneye	Bucephala clangula	0	**5**	1	0	3	1	**10**	3	2	5	S5				G5	S5	2,3	b,c	1,2,3,4,5,6		T									21, 28, 30	
5	ABNJB18020	Barrow's goldeneye	Bucephala islandica	0	**8**	2	2	3	1	**6**	2	2	2	S3				G5	S3	2,3	b,c	1,2,3,4,5,6		T		T							4, 9, 10, 21, 22, 24, 28, 30	MR 2003
5	ABNJB18030	Bufflehead	Bucephala albeola	0	**5**	1	0	3	1	**10**	3	2	5	G5				G5	SZ	2,3	b,c	1,2,3,4,5,6											4, 21, 22, 23, 24, 25, 28, 30	
5	ABNJB20010	Hooded merganser	Lophodytes cucullatus	0	**9**	3	2	3	1	**6**	2	1	3	S3				G5	S3	3	b	1,2,3,4,5,6											1, 21, 22, 23, 25, 28	
5	ABNJB21010	Common merganser	Mergus merganser	0	**9**	3	2	3	1	**7**	2	2	3	S3				G5	S3														1, 21, 23, 25, 28	
5	ABNJB21020	Red-breasted merganser	Mergus serrator	0	**6**	2	0	3	1	**6**	2	2	2	S5				G5	S5				x										28, 30	
5	ABNJB22010	Ruddy duck	Oxyura jamaicensis	0	**7**	3	0	3	1	**7**	2	2	3	S4				G5	S4														21, 22, 28	
5	ABNKA02010	Turkey vulture	Cathartes aura	0	**8**	2	1	2	3	**7**	3	1	3	M		M		G5	S4														1, 2, 4-7, 13, 15-19, 22, 23, 25, 27, 28	
5	ABNKC01010	Osprey	Pandion haliaetus	0	**7**	2	1	2	2	**8**	3	1	4	M		M		G5	S4														1, 2, 4-7, 16, 20, 21, 23, 25, 27, 28, 30	
5	ABNKC06010	White-tailed kite	Elanus leucurus	0	**7**	1	3	2	1	**7**	2	1	4	S2				G5	S2														11, 19, 26	
5	ABNKC19070	Swainson's hawk	Buteo swainsoni	0	**9**	3	1	2	3	**6**	2	1	3	M		M		G5	S3														13, 15, 16, 17, 18, 19, 22, 25	
5	ABNKD06020	American kestrel	Falco sparverius	0	**6**	1	0	2	3	**6**	2	1	3	S4				G5	S4														1, 2, 4-7, 11, 14,-23, 25	
5	ABNKD06030	Merlin	Falco columbarius	0	**7**	2	3	1	1	**8**	3	1	4	C		C		G5	S3	1	b	1,2,3,4,5,6											1, 13, 20, 21, 23, 26, 28, 30	
5	ABNKD06080	Gyrfalcon	Falco rusticolus	0	**7**	2	1	3	1	**8**	2	2	4	M		M		G5	S2														19, 21, 22, 26, 28	
5	ABNLC09010	Spruce grouse	Falcipennis canadensis	0	**8**	3	0	2	3	**7**	2	2	3	S4				G5	S4				x										5, 6, 9, 24	
5	ABNLC09020	Blue grouse	Dendragapus obscurus	0	**6**	2	0	3	1	**8**	2	2	4	S4				G5	S4	3	b,c	1,2,3,4,5,6	x	T	T	T			T				1, 2, 4, 5, 6, 7, 8, 9, 10, 16, 24, 25	
5	ABNLC10030	White-tailed ptarmigan	Lagopus leucurus saxitilis	0	**7**	2	2	2	1	**6**	2	1	3	S3				G5	S3					T		T							9, 10	
5	ABNLC11010	Ruffed grouse	Bonasa umbellus	0	**7**	2	0	3	2	**11**	3	3	5	S5				G5	S5				x										1, 2, 5, 7, 8, 9, 19, 23, 24, 25	
5	ABNME14020	American coot	Fulica americana	0	**4**	1	0	2	1	**7**	2	1	4	S4				G5	S4				x										19, 20, 21, 22, 28	
5	ABNNB02010	Black-bellied plover	Pluvialis squatarola	0	**7**	2	0	2	3	**6**	3	1	2	S4	Limited distribution. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 26, 28	
5	ABNNB02040	Pacific golden-plover	Pluvialis fulva	0	**9**	2	3	2	2	**5**	2	1	2	S2				G5	S2														19, 21, 26, 28	
5	ABNNB03090	Killdeer	Charadrius vociferus	0	**6**	3	0	1	2	**6**	3	1	2	S4				G5	S4								T	T					11, 15-23, 25, 26, 27, 28	
5	ABNND01010	Black-necked stilt	Himantopus mexicanus	0	**7**	2	1	2	2	**6**	2	1	3	M		M		G5	S3														15, 16, 18, 19, 21, 22	
5	ABNND02010	American avocet	Recurvirostra americana	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4										T				15, 16, 18, 19, 21, 22	
5	ABNNF01020	Greater yellowlegs	Tringa melanoleuca	0	**4**	1	0	2	1	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 28, 30	
5	ABNNF03010	Wandering tattler	Heteroscelus incanus	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3	2	b	1,2,3,4,5,6											26, 27	
5	ABNNF04020	Spotted sandpiper	Actitis macularia	0	**5**	1	2	1	1	**5**	2	1	2	S3				G5	S3														15-19, 21, 22, 23, 25, 26, 28	
5	ABNNF07020	Whimbrel	Numenius phaeopus	0	**6**	1	2	1	2	**6**	2	1	3	S3	Irregularly distributed.			G5	S3	2	b	1,2,3,4,5,6											1, 9, 26, 27, 28	
5	ABNNF07070	Long-billed curlew	Numenius americanus	0	**8**	2	1	2	3	**6**	2	1	3	M		M		G5	S2										T			T	15, 16, 17, 18, 19, 22, 28	
5	ABNNF09010	Ruddy turnstone	Arenaria interpres	0	**5**	1	0	2	2	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											26, 27, 28	
5	ABNNF09020	Black turnstone	Arenaria melanocephala	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4					T									21, 26, 27, 28	
5	ABNNF10010	Surfbird	Aphriza virgata	0	**6**	2	0	1	3	**5**	1	1	3	S4				G5	S4					T									26, 27	
5	ABNNF11030	Sanderling	Calidris alba	0	**7**	2	0	2	3	**5**	3	1	1	S4	Vulnerable to oil spills. WA population increasing			G5	S4	2	b	1,2,3,4,5,6											18, 26, 28	
5	ABNNF11050	Western sandpiper	Calidris mauri	0	**9**	4	0	2	3	**6**	3	1	2	S4	Declining population almost certain. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 26, 28	
5	ABNNF11100	Least sandpiper	Calidris minutilla	0	**5**	2	0	1	2	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 28	
5	ABNNF11170	Dunlin	Calidris alpina	0	**5**	2	0	2	1	**7**	3	1	3	S4				G5	S4					T									18, 19, 21, 22, 26, 28	
5	ABNNF16010	Short-billed dowitcher	Limnodromus griseus	0	**7**	3	0	2	2	**6**	3	1	2	S4	Population may be declining. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											19, 21, 26, 28	
5	ABNNF18030	Wilson's snipe	Gallinago delicata	0	**8**	3	0	3	2	**6**	2	1	3	S4				G5	S4				x										11, 19, 22, 28	
5	ABNNF20010	Wilson's phalarope	Phalaropus tricolor	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3										T				18, 21, 22	
5	ABNNF20020	Red-necked phalarope	Phalaropus lobatus	0	**5**	1	0	2	2	**6**	2	1	3	S4				G4	S4	2	b	1,2,3,4,5,6											21, 28, 29, 30, 31, 32	
5	ABNNF20030	Red phalarope	Phalaropus fulicarius	0	**5**	1	0	2	2	**6**	2	1	3	S4	Use of offshore areas not clearly understood. Oil spills.			G5	S4	2	b	1,2,3,4,5,6											31, 32	
5	ABNNM03020	Franklin's gull	Larus pipixcan	0	**5**	2	0	1	2	**6**	2	1	3	G4				G4	SZ													T	19, 21, 22, 26, 28, 30	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
						Concerns					Actions									PHS				Ecoregions										
5	ABNNM03100	Ring-billed gull	Larus delawarensis	0	**6**	2	0	2	2	**8**	3	1	4	S5				G5	S5														19, 20, 21, 22, 26-31	
5	ABNNM03180	Western gull	Larus occidentalis	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4					T									20, 26, 27, 28, 30, 31	
5	ABNNM08020	Caspian tern	Sterna caspia	0	**11**	4	1	2	4	**8**	3	2	3	M		M		G5	S3					T									21, 22, 26, 27, 28, 30	
5	ABNNM08040	Elegant tern	Sterna elegans	0	**4**	1	0	2	1	**8**	2	1	5	G2	Winter migrant only.			G2															26, 27, 28, 30	
5	ABNNM08090	Forster's tern	Sterna forsteri	0	**7**	2	1	2	2	**7**	2	1	4	M		M		G5	S3													T	22, 26, 28, 30	
5	ABNNM10020	Black tern	Chlidonias niger	0	**7**	2	1	2	2	**7**	3	1	3	M		M	Co	G4	S4						T							T	19, 21, 22	
5	ABNNN05020	Pigeon guillemot	Cepphus columba	0	**8**	3	0	2	3	**6**	2	2	2	S4				G5	S4					T									27, 28, 29, 30	
5	ABNNN11010	Rhinoceros auklet	Cerorhinca monocerata	0	**9**	3	0	2	4	**7**	2	2	3	S4				G5	S4					T									27, 28, 29, 30, 31, 32	
5	ABNPB01080	Band-tailed pigeon	Columba fasciata	0	**11**	3	2	3	3	**9**	3	2	4	S3				G4	S3	3	b,c	4,5,6	x	T	T	T	T	T					1, 2, 3, 4, 19, 20, 23, 26, 27, 28	
5	ABNPB04040	Mourning dove	Zenaida macroura	0	**7**	3	0	3	1	**6**	2	1	3	S5				G5	S5				x										1, 2, 7, 11-20, 23, 25	
5	ABNSB01040	Western screech owl	Otus kennicotii macfarlane	0	**4**	1	0	2	1	**7**	2	1	4	S4				G5	S4										T				1, 2, 5, 6, 7, 8, 13, 20, 23, 25	
5	ABNSB06010	Snowy owl	Nyctea scandiaca	0	**6**	1	1	3	1	**8**	2	1	5	M		M		G5	S3														19, 26	
5	ABNSB08010	Northern pygmy owl	Glaucidium gnoma	0	**4**	1	0	1	2	**6**	2	1	3	S4				G5	S4					T									1, 2, 5, 6, 7, 9, 13, 23, 25	
5	ABNSB12020	Barred owl	Strix varia	0	**4**	1	0	2	1	**8**	2	1	5	S5				G5	S5														1, 5, 23	
5	ABNSB13040	Short-eared owl	Asio flammeus	0	**9**	3	2	2	2	**5**	2	1	2	S3				G5	S3						T					T			11, 15, 16, 19, 22	
5	ABNSB15010	Boreal owl	Aegolius funereus	0	**6**	1	1	2	2	**5**	1	1	3	M		M		G5	S3										T				4, 5, 8	
5	ABNTA02020	Common nighthawk	Chordeiles minor	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4						T								1, 2, 4, 5, 6, 7, 11-25	
5	ABNTA04010	Common poorwill	Phalaenoptilus nuttall	0	**8**	2	2	2	2	**6**	1	1	4	S3				G5	S3														2, 5, 6, 7, 15, 16, 17, 18, 19	
5	ABNUA01010	Black swift	Cypseloides niger	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G4	S3							T	T	T	T	T			1, 2, 4, 5, 6, 7, 9, 10, 20-30	
5	ABNUA06010	White-throated swift	Aeronautes saxatalis	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3														5, 7, 14, 15, 16, 17, 18, 19, 21, 22, 25	
5	ABNUC48010	Calliope hummingbird	Stellula calliope	0	**6**	2	0	2	2	**5**	1	1	3	S4				G5	S4								T	T	T		T		24, 25	
5	ABNUC51020	Rufous hummingbird	Selasphorus rufus	0	**7**	3	0	2	2	**5**	2	1	2	S4				G5	S4					T	T	T	T	T	T		T		1, 2, 4-11, 14, 19, 20, 23- 27	
5	ABNYF05020	Red-breasted sapsucker	Sphyrapicus ruber	0	**0**		0			**0**				S4				G5	S4					T										
5	ABNYF05030	Williamson's sapsucker	Sphyrapicus thyroideus	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3									T	T		T		4, 5, 6, 7, 8, 9	
5	ABNYF05040	Red-naped sapsucker	Sphyrapicus nuchalis	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4						T				T		T		1, 2, 4, 23, 24	
5	ABNYF07030	Downy woodpecker	Picoides pubescens	0	**4**	1	0	2	1	**8**	3	1	4	S4				G5	S4														1, 2, 9, 19, 20, 23, 25	
5	ABNYF07110	Three-toed woodpecker	Picoides tridactylus	0	**6**	2	1	1	2	**6**	2	1	3	M		M		G5	S3												T		4, 5, 6, 7, 9, 24	
5	ABPAE32010	Olive-sided flycatcher	Contopus cooperi	0	**6**	2	0	2	2	**6**	2	1	3	S4			Co	G5	S4					T	T	T	T	T	T		T		1, 3, 4, 5, 6, 7, 9, 23, 24, 25	
5	ABPAE32050	Western wood pewee	Contopus sordidulus	0	**3**	1	0	1	1	**6**	2	1	3	S5				G5	S5					T	T								11, 19, 20, 23, 25	
5	ABPAE33040	Willow flycatcher	Empidonax traillii	0	**4**	2	0	1	1	**7**	3	1	3	S4			Co	G5	S4						T	T	T	T	T		T		1, 2,4, 23, 24, 25	
5	ABPAE33080	Hammond's flycatcher	Empidonax hammondii	0	**3**	1	0	1	1	**6**	1	1	4	S5				G5	S5							T			T		T		1, 2, 4, 5, 7	
5	ABPAE33090	Dusky flycatcher	Empidonax oberholseri	0	**3**	1	0	1	1	**7**	2	1	4	S4				G5	S4												T		4, 5, 6, 7, 8, 13, 24, 25	
5	ABPAE33100	Gray flycatcher	Empidonax wrightii	0	**4**	1	1	1	1	**5**	1	1	3	M		M		G5	S2									T				T	6, 7, 13, 16	
5	ABPAE33120	Pacific-slope flycatcher	Empidonax difficilis	0	**3**	1	0	1	1	**7**	2	1	4	S4				G5	S4					T	T	T							1, 2, 4, 23, 24	
5	ABPAE33160	Cordilleran flycatcher	Empidonax occidentalis	0	**6**	2	2	1	1	**6**	1	1	4	S3				G5	S3												T		5, 25	
5	ABPAE43050	Ash-throated flycatcher	Myiarchus cinerascens	0	**9**	3	1	2	3	**4**	1	1	2	M		M		G5	S2														2, 11, 13, 20	
5	ABPAU07010	Northern rough-winged swallow	Stelgidopteryx serripennis	0	**7**	2	0	2	3	**5**	1	1	3	S4				G5	S4														1, 2, 4-7, 11, 13-18, 21-23, 25-28, 30	
5	ABPAW01010	Blackcapped chickadee	Poecile atricapilla	0	**4**	1	0	2	1	**7**	3	1	3	S5				G5	S5														1, 2, 20, 23, 25	
5	ABPAW01060	Boreal chickadee	Poecile hudsonicus	0	**5**	1	1	2	1	**6**	1	1	4	M	Peripheral species -- JA	M		G5	S3														4, 9, 24	
5	ABPAW01070	Chestnut-backed chickadee	Poecile rufescens	0	**4**	1	0	2	1	**7**	2	1	4	S5				G5	S5					T	T								1, 4, 5, 20, 23, 24	
5	ABPBA01010	Brown creeper	Certhia americana	0	**5**	2	0	1	2	**6**	2	1	3	S4				G5	S4								T	T					1, 2, 4, 5, 6, 7, 20, 23, 24, 25	
5	ABPBG03010	Rock wren	Salpinctes obsoletus	0	**4**	1	0	2	1	**4**	1	1	2	S4				G5	S4														13, 15, 16	
5	ABPBG04010	Canyon wren	Catherpes mexicanus	0	**3**	1	0	1	1	**4**	1	1	2	S4				G5	S4										T				4, 5, 6, 7, 13, 14, 15, 16, 17, 25	
5	ABPBG09050	Winter wren	Troglodytes troglodytes	0	**3**	1	0	1	1	**7**	2	1	4	S5				G5	S5														1, 4, 5, 9, 23, 24, 25, 26	
5	ABPBG10020	Marsh wren	Cistothorus palustris	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4														22, 28	
5	ABPBH01010	American dipper	Cinclus mexicanus	0	**6**	2	0	2	2	**6**	2	1	3	S5				G5	S5							T			T				21, 23	
5	ABPBJ05010	Golden-crowned kinglet	Regulus satrapa	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4					T	T								1, 2, 4, 5, 7, 9, 20, 23, 24, 25	
5	ABPBJ18080	Veery	Catharus fuscescens	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3										T		T	T	25	
5	ABPBJ18100	Swainson's thrush	Catharus ustulatus	0	**4**	2	0	1	1	**6**	2	1	3	S5				G5	S5												T		1, 4, 5, 8, 23, 24, 25	
5	ABPBX03010	Yellow warbler	Dendroica petechia	0	**5**	2	0	1	2	**7**	3	1	3	S4				G5	S4										T		T		23, 25	
5	ABPBX03070	Black-throated gray warbler	Dendroica nigrescens	0	**3**	1	0	1	1	**6**	1	1	4	S5				G5	S5					T	T	T	T	T					1, 2, 5, 7, 23	
5	ABPBX03080	Townsend's warbler	Dendroica townsend	0	**4**	1	0	2	1	**6**	2	1	3	S4				G5	S4						T		T	T			T		1, 2, 4, 5, 9, 20, 23, 24	
5	ABPBX03090	Hermit warbler	Dendroica occidentalis	0	**3**	1	0	1	1	**4**	2	1	1	S4				G4	S4					T	T		T	T					1, 2, 4, 23, 24	
5	ABPBX10020	Northern waterthrush	Seiurus noveboracensis	0	**7**	2	1	2	2	**7**	2	1	4	M	Peripheral species -- JA.	M		G5	S3														23, 25	
5	ABPBX11040	Macgillivray's warbler	Oporornis tolmiei	0	**5**	2	0	1	2	**6**	2	1	3	S4				G5	S4												T	T	1, 2, 4, 5, 7, 9, 23, 24, 25	
5	ABPBX16020	Wilson's warbler	Wilsonia pusilla	0	**3**	1	0	1	1	**6**	2	1	3	S5				G5	S5												T	T	1, 2, 4, 5, 23, 24, 25	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	179 SGCN	CRITERIA 9.5 Y-Axis	Concerns: Threats	Current status	Socio-econ value	Vulnerability	7.5 X-Axis	Actions: Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS: Criteria	Area	Region	WDFW Game Plan	Ecoregions: NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABPBX24010	Western yellow-breasted chat	Icteria virens auricollis	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3										T				1, 2, 19, 23, 25	
5	ABPBX45050	Western tanager	Piranga ludoviciana	0	**4**	1	0	2	1	**6**	2	1	3	S5				G5	S5														1, 2, 4, 5, 6, 7, 8, 9, 23, 24, 25	
5	ABPBX74010	Green-tailed towhee	Pipilo chlorurus	0	**9**	1	3	2	3	**5**	1	1	3	S2	Peripheral species.	M		G5	S2													T	4, 5, 6, 7, 8, 13, 15, 16	
5	ABPBX94040	Brewer's sparrow	Spizella breweri	0	**9**	3	2	1	3	**5**	2	1	2	S3				G5	S3										T			T	15, 16, 17, 18	
5	ABPBX97010	Black-throated sparrow	Amphispiza bilineata	0	**8**	2	4	1	1	**3**	1	1	1	S1	Peripheral species.			G5	S1														16, 17, 18	
5	ABPBXA0020	Grasshopper sparrow	Ammodramus savannarum	0	**7**	3	1	1	2	**7**	3	2	2	M		M		G5	S3						T				T			T	11, 15, 16, 17, 19	
5	ABPBXA9010	Bobolink	Dolichonyx oryzivorus	0	**8**	3	1	2	2	**5**	2	1	2	M	Peripheral, associated with agriculture.	M		G5	S2										T			T	19, 22, 25	
5	ABPBXB0020	Tricolored blackbird	Agelaius tricolor	0	**8**	1	3	1	3	**5**	1	1	3	S2				G3	S2						T								22	
5	ABPBY04030	Cassin's finch	Carpodacus cassinii	0	**5**	2	0	2	1	**5**	1	1	3	S4				G5	S4										T				4, 5, 6, 7, 8, 9, 13, 24, 25	
5	ABPBY06010	Common redpoll	Carduelis flammea	0	**7**	1	3	2	1	**7**	2	1	4	S2	Not a breeder.			G5	S2														4, 5, 9, 10, 24, 25	
5	ABPBY06090	Lesser goldfinch	Carduelis psaltria	0	**5**	2	1	1	1	**5**	1	1	3	M	Peripheral, recent range expansion	M		G5	S2														2, 11, 19, 23	
4	ARAAD01010	Painted turtle	Chrysemys picta	0	**8**	3	0	2	3	**7**	3	1	3	S5				G5	S5						T								2, 7, 14, 15, 16, 21, 22, 23, 25	
4	ARACB01040	Southern alligator lizard	Elgaria multicarinata	0	**6**	2	1	1	2	**4**	1	1	2	M		M		G5	S4														2, 11	
4	ARACF14080	Western fence lizard	Sceloporus occidentalis	0	**6**	2	0	1	3	**6**	1	2	3	G5																			1, 2, 5, 6, 7, 11-17, 19, 20, 26	
4	ARADA01010	Rubber boa	Charina bottae	0	**4**	1	0	1	2	**6**	2	1	3	S4				G5	S4										T				1, 2, 4,-8, 11, 13, 14, 16, 17, 19--24, 25	
4	ARADB10010	Ringneck snake	Diadophis punctatus	0	**7**	2	1	1	3	**5**	2	1	2	M		M		G5	S3						T								1, 2, 3, 7, 11, 12, 16	
4	ARADB18010	Night snake	Hypsiglena torquata	0	**8**	3	1	1	3	**5**	2	1	2	M		M		G5	S2										T				5, 6, 7, 13, 14, 15, 16, 17, 18	
4	ARADE02120	Western rattlesnake	Crotalus viridis	0	**9**	3	0	2	4	**6**	3	1	2	S5				G5	S5						T			T	T				1, 3, 5, 6, 7, 8, 11-19, 23, 25	
3	AAAAA01080	Long-toed salamander	Ambystoma macrodactylum	0	**3**	1	0	1	1	**7**	3	2	2	S5				G5	S5														7, 13, 15, 16, 17, 19, 20, 21, 22, 25	
3	AAAAH01010	Cope's giant salamander	Dicamptodon copei	0	**8**	3	1	1	3	**5**	1	2	2	M		M		G3	S3					T	T		T						1, 21, 23	
3	AAAAH01040	Coastal giant salamander	Dicamptodon tenebrosus	0	**5**	2	0	1	2	**6**	2	2	2	S5				G5	S5						T								1, 2, 3, 4, 5, 23	
3	AAAAJ01010	Olympic torrent salamander	Rhyacotriton olympicus	0	**8**	3	1	1	3	**5**	1	2	2	M	Much of population protected in ONP	M	Co	G3	S3					T	T								1, 4, 23	
3	AAABA01010	Tailed frog	Ascaphus truei	0	**8**	3	1	2	2	**8**	3	2	3	M		M	Co	G4	S4					T	T		T	T	T				1, 4, 5, 23, 25	
3	AAABB01180	Woodhouse's toad	Bufo woodhousi	0	**6**	2	1	1	2	**5**	2	1	2	M		M		G5	S3												T		15, 16, 17, 18, 19, 20, 21, 22, 25	
3	AAABH01020	Northern red-legged frog	Rana aurora aurora	0	**9**	4	0	2	3	**6**	3	1	2	S4			Co	G4	S4					T	T		T	T					1, 2, 4, 11, 21, 22, 23, 25	
3	AAABH01060	Cascades frog	Rana cascadae	0	**8**	3	1	2	2	**7**	2	1	4	M		M	Co	G4	S4					T			T	T					4, 9, 21, 22, 23, 24, 25	
2	AFC4A06040	Brown rockfish	Sebastes auriculatus	0	**12**	2	3	3	4	**8**	2	2	4	C	Young whippersnappers at 35 years life span	C	Co			1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06190	Puget Sound rockfish	Sebastes emphaeus	0	**7**	1	3	1	2	**6**	1	1	4	C		C									T									
2	AFC4A06210	Widow rockfish	Sebastes entomelas	0	**10**	2	3	2	3	**8**	2	1	5	C		C				1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003, SR 2
2	AFC4A06240	Yellowtail rockfish	Sebastes flavidus	0	**12**	3	3	3	3	**8**	2	1	5	C		C				1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003, SR 2
2	AFC4D02010	Lingcod	Ophiodon elongatus	0	**7**	2	0	3	2	**8**	2	2	4							2,3	a	4,6			T									
2	AFC4E02050	Mottled sculpin	Cottus bairdi	0	**4**	1	0	2	1	**5**	3	1	1	S4				G5	S4										T			T	21	
2	AFC4E02060	Piute sculpin	Cottus beldingi	0	**5**	1	1	2	1	**3**	1	1	1	M		M		G5	S3									T				T	21	
2	AFC4E02080	Slimy sculpin	Cottus cognatus	0	**7**	2	1	2	2	**5**	3	1	1	M		M		G5	S3													T	21	
2	AFC4E02090	Shorthead sculpin	Cottus confusus	0	**0**		0			**0**																	T	T				21	
2	AFCAA01050	White sturgeon (Columbia River)	Acipenser transmontanus pop.2	0	**13**	4	2	3	4	**10**	3	3	4	S3				G4	S3					T	T		T	T		T			21	
2	AFCHA0208A	Coastal resident/searun cutthroat	Oncorhynchus clarki clark	0	**6**	2	0	2	2	**7**	2	1	4	G4			Co	G4	SU	3	a	4,5,6				T								21, 28, 29, 30, 31, 32	MR 1991
2	AFCHA05040	Dolly varden	Salvelinus confluentus/malma	0	**9**	3		3	3	**8**	3	1	4	C		C	T	G3	S3	1,2,3	a	1,2,3,4,5,6								T			21, 28, 29, 30, 31, 32	
2	AFCHB03010	Longfin smelt	Spirinchus thaleichthys	0	**7**	2	2	1	2	**8**	2	2	4	S3				G5	S3	2,3	b,c	4,6													
2	AFCJB06010	Lake chub	Couesius plumbeus	0	**8**	2	3	1	2	**4**	2	1	1	C		C		G5	S2	1	a	1,2,3,5							T				21	
2	AFCJB13030	Tui chub	Gila bicolor	0	**9**	2	3	1	3	**4**	2	1	1	S2				G4	S2													T	21	
2	AFCJB37050	Speckled dace	Rhinichthys osculus	0	**4**	1	0	2	1	**4**	2	1	1	S5				G5	S5										T	T		T	21	
2	AFCJB37110	Nooksack dace	Rhinichthys sp. 4	0	**4**	1	0	2	1	**3**	1	1	1	G3		M		G3	S4						T								21	
2	AFCJB37120	Umatilla dace	Rhinichthys umatilla	0	**9**	2	3	2	2	**3**	1	1	1	C		C		G4	S2	1	a	1,2,3						T	T				21	
2	AFCJC02030	Longnose sucker	Catostomus catostomus	0	**4**	1	0	2	1	**4**	2	1	1	S4				G5	S4													T	21	
2	AFCLC01020	Sand roller	Percopsis transmontana	0	**5**	1	1	2	1	**3**	1	1	1	M		M		G4	S3									T				T	21	
2	AFCMA01010	Burbot	Lota lota	0	**9**	3	2	2	2	**11**	3	3	5	S3				G5	S3											T			21	
2	AFCMA08010	Pacific cod (S&C Puget Sound)	Gadus macrocephalus	0	**12**	2	3	3	4	**10**	3	2	5	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFCMA10020	Pacific hake (C Puget Sound)	Merluccius productus	0	**12**	2	3	3	4	**8**	3	1	4	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003, SR 2001
2	AFCMA14010	Walleye pollock (S. Puget Sound)	Theragra chalcogramma	0	**13**	3	3	3	4	**8**	3	1	4	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFCTB16080	Rock sole	Lepidopsetta bilineata	0	**8**	3	0	3	2	**6**	3	1	2							3	b,c	4,6												
2	AFCTB16100	English sole	Pleuronectes vetulus	0	**7**	3	0	3	1	**10**	3	3	4							3	b,c	4,6												
2	AFDEA07010	Dogfish shark	Squalus acanthias	0	**8**	2	0	2	4	**7**	3	1	3																					

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

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					CRITERIA: Concerns						Actions									PHS				Ecoregions										
1	ICMAL05910	A cave obligate amphipod	Stygobromus elliotti	0	7	3	0	1	3	3	1	1	1	G1	Only occurs in WA. Mentioned in Grande Ronde subbasin plan.			G1	SU															
1	ICMALC2010	Dungeness crab	Cancer magister	0	7	2	0	3	2	11	3	3	5							2,3	b,c	4,6											28, 29, 30, 31	
1	ICMALC3010	Pandalid shrimp	Pandalus spp.	0	9	2	0	3	4	10	2	3	5							2,3	c	4,6											28, 29, 30, 31	
1	IDHYD06010	Polyorchis jellyfish	Polyorchis penicillatus	0	7	3	0	1	3	4	2	1	1												T								1	
1	IEECH11010	Red urchin	Strongylocentrotus franciscanus	0	9	3	0	3	3	8	1	2	5							3	c	4,6											28, 29, 30, 31	
1	IICLL04030	A springtail	Arrhopalites clarus	0	0		0			1	1			G2				G2																
1	IICOL6E090	Roth's blind ground beetle	Pterostichus rothi	0	0		0			1	1			G1	Not enough known to rank			G1						T										
1	IICOL6E170	Johnson's Waterfall carabid beetle	Pterostichus johnsoni	0	0					0																	T							
1	IICOL6E210	A ground beetle	Pterostichus inanis	0	0					0																	T							
1	IICOL6E220	A ground beetle	Pterostichus smetani	0	0					0																	T							
1	IICOL6L161	A ground beetle	Nebria vandykei vandykei	0	0					0					Endemic												T							
1	IICOL6L190	Mann's gazelle beetle	Nebria danmanni	0	8	3	0	1	4	5	1	1	3											T									9, 10	
1	IICOLB7070	A rove beetle	Quedius bakeri	0	0					0																	T							
1	IICOLB7080	A rove beetle	Quedius narada	0	0					0																	T							
1	IICOLB7090	A rove beetle	Quedius paradisi	0	0					0																	T							
1	IICOLB7100	A rove beetle	Quedius tahomae	0	0					0																	T							
1	IICOLW8010	Wood-borer beetle	Buprestis gibbsi	0	0		0			1	1				Not enough known to rank										T			T						
1	IICOLW9010	A rove beetle	Coryphium vandykei	0	0					0																	T							
1	IICOLX1010	A rove beetle	Gnathoryphium mandibulare	0	0					0																	T							
1	IICOLX2010	Wood-borer beetle	Oistus edmonstoni	0	0		0			1	1				Not enough known to rank										T									
1	IICOLX3010	A rove beetle	Subhaida rainieri	0	0					0																	T							
1	IICOLX4010	A rove beetle	Tachinus ovalis	0	0					0																	T							
1	IIEPH33360	A mayfly	Paraleptophlebia vaciva	0	0		0			1	1			G2				G2															21	
1	IIEPH43130	A mayfly	Epeorus hesperus	0	0		0			1	1			G2				G2															21	
1	IIEPH50120	A mayfly	Drunella pelosa	0	0		0			1	1			G2				G2															21	
1	IIEPH57030	A mayfly	Ametropus ammophilus	0	0		0			1	1			G2				G2															21	
1	IIHEM07020	Hairy shore bug	Saldula villosa	0	0		0			1	1			G3				G3						T										
1	IIHEM40090	Mirid bug	Ceratocapsus downesi	0	0		0			1	1														T									
1	IIHEM69010	Mirid bug	Clivenema fusca	0	0		0			1	1														T									
1	IIHEMF0010	Coreid bug	Coriomeris insularis	0	0		0			1	1														T									
1	IILEP04020	Silver-spotted skipper	Epargyreus clarus californicus	0	8	3	1	1	3	4	1	1	2	M		M		G5	S4														2, 11, 19, 23	
1	IILEP16020	Northern cloudy wing (western WA)	Thorybes pylades	0	7	3	1	1	2	3	1	1	1	M	M for western WA only.	M		G5	S3														2, 7, 14, 19, 23, 2 5	
1	IILEP37010	Dreamy duskywing (western WA)	Erynnis icelus	0	8	3	1	1	3	3	1	1	1	M		M		G5	S4														4, 5, 8, 14, 19, 23, 24, 25	
1	IILEP37110	Pacuvius (Dyar's) duskywing	Erynnis pacuvius lilius	0	6	2	1	1	2	4	1	1	2	M	Species is ceonothus-dependent	M		G5	S2														5, 7, 12	
1	IILEP37170	Persius duskywing (PT, Willapa)	Erynnis persius	0	8	3	1	1	3	4	1	1	2	M	M for Puget Trough and Willapa Hills populations only	M		G5	S5														9, 10, 11, 14	
1	IILEP38010	Grizzled skipper	Pyrgus centaureae	0	7	2	1	1	3	3	1	1	1	M		M		G5	S2							T			T				9, 10	
1	IILEP42011	Arctic skipper (western WA)	Carterocephalus palaemon mandan	0	8	3	1	1	3	3	1	1	1	M	Habitats listed for W WA only	M		G5	S3														11, 19, 22, 23, 28	
1	IILEP57020	Garita skipperling	Oarisma garita	0	7	2	1	1	3	3	1	1	1	M		M		G5	S2										T				4, 19, 22	
1	IILEP65020	Juba skipper (western WA)	Hesperia juba	0	8	3	1	1	3	4	1	1	2	M	M for western WA only.	M		G5	S5														11, 14, 15, 16, 17, 19	
1	IILEP65030	Common branded skipper	Hesperia comma	0	0		0			2	2			S5	one is this? (NW Coast - ask Jeff Lewis)			G5	S5					T		T								
1	IILEP65180	Nevada skipper	Hesperia nevada	0	8	3	1	1	3	3	1	1	1	M		M		G5	S2														9, 10, 15, 16	
1	IILEP66010	Peck's skipper	Polites peckius	0	8	3	1	1	3	3	1	1	1	M		M																	22, 24, 25	
1	IILEP66060	Tawny-edged skipper	Polites themistocles	0	7	2	1	1	3	3	1	1	1	M		M		G5	S2														22, 24, 25	
1	IILEP66080	Long dash skipper	Polites mystic	0	8	3	1	1	3	3	1	1	1	M		M		G5	S4														22, 24, 25	
1	IILEP66090	Sonora skipper	Polites sonora sonora	0	7	3	1	1	2	4	1	1	2	M		M		G4	S4														9, 15, 22, 24, 25	
1	IILEP72010	Bonneville skipper	Ochlodes sylvanoides bonnevilla	0	7	3	1	1	2	3	1	1	1	M		M		G5	S5														15, 16, 17, 19, 22, 25	
1	IILEP72011	Woodland skipper, coastal spp.	Ochlodes sylvanoides orecoastus	0	8	3	1	1	3	3	1	1	1	M		M		G5	S5					T									26, 27	
1	IILEP77100	Kiowa skipper	Euphyes vestris kiowah	0	4		4			1	1			S1	Not enough known to rank	M		G5	S1														22, 25	
1	IILEP77101	Dun skipper	Euphyes vestris vestris	0	7	3	1	1	2	3	1	1	1	M		M		G5	S3						T								11, 22	
1	IILEP80180	Roadside skipper	Amblycirtes vialis	0	7	3	1	1	2	4	1	1	2	M		M		G5	S4													T	5, 6, 7	
1	IILEP90020	Clodius parnassian	Parnassius clodius altaurus (gallatinu	0	8	3	1	1	3	3	1	1	1	M	Recommended inclusion M taxon	M		G5	SU														4, 8, 9, 14	
1	IILEP90054	Smintheus parnassian	Parnassius smintheus olympiannus	0	7	2	0	2	3	5	1	1	3	S4				G5	S4					T									9, 10	
1	IILEPA1020	Spring white	Pieris sysymbrii flavitincta	0	6	2	0	1	3	4	1	1	2	S4				G5	S4					T									8, 10 (WWA) 14, 15, 16, 25 (E WA)	
1	IILEPA8040	Western sulphur (Strait of Juan de Fuca)	Colias occidentalis occidentalis	0	7	3	0	1	3	4	1	1	2	G3	M for Straits of Juan de Fuca only.	M		G3	S5						T	T							11, 19, 27	
1	IILEPA8042	Intermountain sulphur	Colias occidentalis pseudochristina	0	4		4			1	1			S1				G3	S1														4, 9, 10	

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1	IILEPA8100	Arctic sulphur	Colias nastes streckeri	0	**8**	3	0	1	4	**4**	1	1	2	S4				G5	S4														9, 10	
1	IILEPC1020	Lustrous copper	Lycaena cuprea henryae	0	**9**	3	1	2	3	**3**	1	1	1	M	Scree slopes.	M		G5	S2							T							9, 10, scree slopes	
1	IILEPC1050	Edith's copper	Lycaena editha editha	0	**7**	3	1	1	2	**3**	1	1	1	M		M		G5	S4														5, 9, 24	
1	IILEPC1080	Ruddy copper	Lycaena rubida perkinsorum	0	**9**	3	1	2	3	**4**	1	1	2	M		M		G5	S4														7, 13, 15, 16, 19	
1	IILEPC1130	Purplish copper	Lycaena helloides	0	**4**	1	1	1	1	**6**	2	1	3	M		M		G5	S5														1, 2, 4-9, 11, 14, 19, 20, 22, 23, 25-28	
1	IILEPC1140	Nivalis copper	Lycaena nivalis brown	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G5	S3					T									4, 5, 9, 14, 16	
1	IILEPD4010	Behr's hairstreak	Satyrium behrii columba	0	**7**	3	0	1	3	**3**	1	1	1	S4	Recommended addition. Okanogan EA . Purschia tridentata	M		G5	S4														16	
1	IILEPD4050	Sylvan hairstreak	Satyrium sylvinum sylvinum	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G4	S4												T	T	14, 22, 25	
1	IILEPD4140	Coral hairstreak	Harkenclenus titus immaculosus	0	**6**	2	1	1	2	**4**	1	1	2	M		M		G5	S4														14, 19, 25	
1	IILEPE2050	Washington green hairstreak	Callophrys affinis washingtonia	0	**7**	3	1	1	2	**4**	1	1	2	M	lithosols	M		G5	S4														15, 16, 17	
1	IILEPE2070	Canyon green hairstreak	Callophrys sheridanii neoperplexa	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S3														9, 10, 14, 15, 16, 17	
1	IILEPE2080	Bramble green hairstreak	Callophrys dumetorum	0	**9**	3	1	1	4	**3**	1	1	1	M	Heath scrub	M			S2														1, 2, 5, 6, 7, 15, 19, heath scrub	
1	IILEPE2090	Thicket hairstreak	Mitoura spinetorum spinetorum	0	**9**	3	1	2	3	**3**	1	1	1	M		M		G5	S3														4, 5, 6, 7	
1	IILEPE2112	Arborvitae hairstreak	Mitoura grynea rosneri	0	**7**	3	1	1	2	**3**	1	1	1	M		M																	4, 5	
1	IILEPE2200	Moss elfin (western WA)	Incisalia mossii mossii	0	**9**	3	1	1	4	**3**	1	1	1	M	M for western WA only. Rock outcrops and cliffs.	M		G4	S3					T									1, 2, 4, 5, 7, 9, 11, 14, 15, 27, rock outcrops and cliffs	
1	IILEPE2250	Shelton pine elfin	Incisalia eryphon sheltonensis	0	**6**	2	1	1	2	**3**	1	1	1	M		M		G5	S3														2, 6, 11	
1	IILEPF9010	Eastern tailed blue	Everes comyntas comyntas	0	**3**		3			**1**	1			S2	Not enough known to rank	M		G5	S2										T			T	19, 25	
1	IILEPG501F	Anna's blue	Lycaeides anna ricei	0	**0**					**0**														T			T							
1	IILEPG6010	Greenish blue (Olympic Peninsula	Plebejus saepiolus (all ssp. In area)	0	**6**	2	0	1	3	**4**	1	1	2	S5				G5	S5					T									9, 10, 19, 22, 24, 25	
1	IILEPG8060	Acmon blue	Plebejus acmon spangelatus	0	**6**	2	0	1	3	**5**	1	1	3	S5				G5	S5					T									9, 10	
1	IILEPH0050	Mountain blue	Agriades glandon megalo	0																				T										
1	IILEPJ6101	Egleis fritillary	Speyeria egleis mcdunnough	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S2														9, 10	
1	IILEPJ6102	Egleis fritillary	Speyeria egleis owen	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S2								T	T					9, 10	
1	IILEPJ6120	Hydaspe fritillary	Speyeria hydaspe rhodope	0	**1**		1			**1**	1			M	M for San Juans population only. Found throughout W WA.	M		G4	S4														1, 2, 9, 11, 22, 23, 24	
1	IILEPJ6130	Mormon fritillary	Speyeria mormonia washingtonia	0	**0**					**0**																	T	T						
1	IILEPJ7040	Meadow fritillary	Boloria bellona todd	0	**9**	3	1	1	4	**3**	1	1	1	M		M		G5	S2										T				8, 9, 10, 15, 19, 22, 24, 25	
1	IILEPJ7100	Freija fritillary	Boloria freija freija	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2										T				9, 10	
1	IILEPJ7120	Astarte fritillary	Boloria astarte astarte	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3							T			T				9, 10	
1	IILEPJ7140	Arctic fritillary	Boloria chariclea rainier	0	**5**	2	0	1	2	**5**	1	1	3	S5				G5	S5					T									4, 9, 10, 22, 24	
1	IILEPJ9160	Northern checkerspot	Chlosyne palla sterope	0	**0**					**0**																		T						
1	IILEPK3080	Pale crescent	Phyciodes pallidus barnes	0	**8**	2	2	1	3	**3**	1	1	1	S3				G5	S3														14, 15	
1	IILEPK3100	Pasco pearl crescent	Phyciodes cocyta pascoensis	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S4														14, 15, 16, 19, 22, 25	
1	IILEPK4032	Chalcedon checkerspot	Euphydryas chalcedona perdiccas	0	**7**	2	1	1	3	**5**	1	1	3	M	M for Puget Trough populations only, which are no longer recognized as this subspecies.	M		G5	S2					T									9, 10	
1	IILEPK4050	Edith's checkerspot	Euphydryas editha colonia	0	**5**	2	0	1	2	**5**	1	1	3	S5				G5	S5					T									9,10	
1	IILEPK4071	Hopfinger's checkerspot	Euphydryas anicia hopfingeri	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S5														7, 9, 14, 16, 25	
1	IILEPK5091	Oreas anglewing	Polygonia oreas threatful	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3							T			T				1, 4, 9, 22, 23, 24, 25	
1	IILEPK6010	Compton tortoiseshell	Nymphalis vau-album watson	0	**8**	3	1	2	2	**3**	1	1	1	M		M		G5	S3							T					T		4, 5, 8, 14, 23, 25	
1	IILEPK7010	American painted lady	Vanessa virginiensis	0	**7**	2	1	2	2	**5**	2	1	2	M	Vagrant, emigrant	M		G5	SZ								T	T					14, 15, 16, 19, 26	
1	IILEPL3020	Viceroy	Limenitis archippus lahontan	0	**9**	3	1	2	3	**4**	2	1	1	M		M		G5	S4										T				14, 19, 22, 25	
1	IILEPN6038	Vancouver ringlet	Coenonympha tullia insulana	0	**7**	3	1	1	2	**5**	2	1	2	M		M		G3	S3					T									11, 19	
1	IILEPN8010	Vidler's alpine	Erebia vidleri	0	**7**	2	2	1	2	**4**	1	1	2	S3				G4	S3					T		T							4, 9, 10	
1	IILEPP1045	Chryxus arctic	Oeneis chryxus valerata	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2					T									9, 10	
1	IILEPP1100	Melissa arctic	Oeneis melissa beani	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2							T			T				9, 10	
1	IILEPP2010	Monarch	Danaus plexippus	0	**8**	3	0	3	2	**4**	2	1	1	S4				G4	S4														14, 15, 19, 25	
1	IILEX13030	Clark's sphinx moth	Proserpinus clarkiae	0	**0**		0			**1**	1				Not enough known to rank										T									
1	IILEY89400	An underwing moth	Catocala allusa	0	**0**		0			**1**	1			G4	Not enough known to rank			G4	SU						T									
1	IIODO26060	Western river cruiser	Macromia magnifica	0	**9**	2	2	2	3	**3**	1	1	1	S3	Recommended deletion.			G4	S3										T				21	
1	IIODO65010	River jewelwing	Calopteryx aequabilis	0	**6**	2	0	2	2	**3**	1	1	1	S4				G5	S4						T								21, 22	
1	IIODO71290	Alkali bluet	Enallagma clausum	0	**8**	3	0	2	3	**3**	1	1	1	S4	Recommended inclusion.			G5	S4															
1	IIORT08020	An ice cricket	Grylloblatta chirugica	0	**0**					**0**																		T						
1	IIORTF1010	Olympic grasshopper	Nisquallia olympica	0	**8**	3	0	1	4	**5**	1	1	3	G1				G1						T									9, 10	
1	IIPLE0G030	A stonefly	Megaleuctra kincaidi	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE0G050	A stonefly	Megaleuctra stigmata	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE0J110	A stonefly	Malenka wenatchee	0	**0**		0			**1**	1			G2				G2															21	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
						Concerns					Actions																							
1	IIPLE0K010	Meltwater lednian stonefly	Lednia tumana	0	4		4			1	1			S1				G1	S1														21	
1	IIPLE1B020	A stonefly	Kathroperla takhoma	0	0		0			1	1			G2				G2															21	
1	IIPLE1G020	Fender's soliperlan stonefly	Soliperla fenderi	0	4		4			3	1	1	1	S1			Co	G2	S1														21	
1	IIPLE24480	A stonefly	Isoperla raineri	0	0		0			1	1			G2				G2															21	
1	IIPLE27050	A stonefly	Megarcys yosemite	0	0		0			1	1			G2				G2															21	
1	IITRI19040	Fender's rhyacophilan caddisfly	Rhyacophila fender	0	0		0			1	1														T								21	
1	IITRI2A020	Vertrees' ceraclean caddisfly	Ceraclea vertreesi	0	0		0			1	1														T								21	
1	IITRI9050	Haddock's rhyacophilan caddisfly	Rhyacophila haddocki	0	0		0			1	1			G1				G1						T									21	
1	ILACA11010	A cave obligate mite	Elliotta howarth	0	7	3	0	1	3	3	1	1	1	G1	WA, ID. Mentioned in Grande Ronde subbasin plan.			G1	SU															
1	IMBIV60010	Native mussel	Mytilus trossulus	0	10	4	0	3	3	8	3	2	3																				28, 30	
1	IMBIV61010	Littleneck clam	Protothaca staminea	0	7	2	0	3	2	9	2	3	4							2,3	c	4,8											28, 30	
1	IMBIV62010	Butter clam	Saxidomus giganteus	0	7	2	0	3	2	9	2	3	4							2,3	c	4,7											28, 30	
1	IMBIV63010	Razor clam	Siliqua patula	0	9	3	0	3	3	10	3	3	4							2,3	c	6											26	
1	IMBIV64010	Rock scallop	Crassedoma giganteum	0	5	1	0	3	1	7	2	2	3												T								28, 29, 30	
1	IMBIVA1020	Geoduck clam	Panopea abrupta	0	9	3	0	3	3	9	2	3	4							2,3	c	4,6											28, 29, 30	
1	IMBIVB9030	Olympia oyster	Ostrea conchaphila	0	13	4	3	3	3	8	1	3	4	C		C				1,2,3	a,c	6			T								28, 30	
1	IMGAS20040	Pacific vertigo	Vertigo andrusiana	0	8	3	0	1	4	3	1	1	1	G1	Records also from BC to OR, not much known			G1															1	
1	IMGAS21020	Western flat-whorl	Planogyra clappi	0	6	3	0	1	2	4	2	1	1	G3	Shown to decline in logged habitats (Ovaska and Sopuck, 2001)			G3															1	
1	IMGAS59010	Keeled jumping-slug	Hemphillia burrington	0	7	2	0	2	3	3	1	1	1	G1				G1						T									1	
1	IMGAS59050	Warty jumping-slug	Hemphillia glandulosa	0	7	2	0	2	3	4	2	1	1	G2				G2						T	T								1	
1	IMGAS59060	Malone jumping-slug	Hemphillipa malonei	0	0		0			0				G2				G2						T										
1	IMGAS59070	Panther jumping-slug	Hemphillia pantherina	0	0					0																	T							
1	IMGAS80010	Northern tightcoil	Pristiloma arcticum	0	9	3	0	1	5	4	2	1	1	G2	(crenophilic). Only 3 localities known from WA (Burke et al., 1999)			G2															1	
1	IMGAS80050	Broadwhorl tightcoil	Pristiloma johnsoni	0	7	3	0	1	3	3	1	1	1	G2				G2															1	
1	IMGAS80140	Shiny tightcoil	Pristiloma wascoense	0	8	3	0	1	4	3	1	1	1	G2	Blue Mountains. Records also from ID and OR, not much known			G2															5	
1	IMGAS87020	Evening fieldslug	Deroceras hesperium	0	7	3	0	1	3	3	1	1	1	G1	Swamps or seeps, usually containing skunk cabbage			G1						T	T								23	
1	IMGAS93010	Puget oregonian (snail)	Cryptomastix devia	0	9	4	0	2	3	4	2	1	1	G2	talus, and Chelan Co. and Wenatchee Ranger District.			G2						T	T								1, 14	
1	IMGASB5840	Chelan mountainsnail	Oreohelix sp. 1	0	0					0																		T						
1	IMGASE5020	Glossy valvata	Valvata humeralis	0	3		3			1	1			S2				G5	S2														21	
1	IMGASE5040	Ramshorn valvata	Valvata mergella	0	0		0			1	1			G2				G2						T									21	
1	IMGASE5080	Threeridge valvata	Valvata tricarinata	0	4		4			1	1			S1				G5	S1														21	
1	IMGASF4270	Columbia duskysnail	Lyogyrus sp. 4	0	0		0			1	1														T								21	
1	IMGASG3040	Giant Columbia spire snail	Fluminicola columbiana	0	3		3			1	1			S2		C	Co	G2	S2	1,2	a	1,2,3			T							T	21	
1	IMGASG3130	Olympia pebblesnail	Fluminicola virens	0	0		0			1	1			G2				G2						T									21	
1	IMGASK4020	Bulb juga (snail)	Juga bulbosa	0	0		0			1	1																					T	21	
1	IMGASK4032	Dalles juga	Juga hemphilli dallesensis	0	0					0																	T	T						
1	IMGASK4033	Barren juga	Juga hemphilli hemphill	0	4		4			1	1			S1				G2	S1						T								21	
1	IMGASK4100	Basalt juga	Juga (Oreobasis) sp. 1	0	0					0																	T	T						
1	IMGASL5210	Widelip pondsnail	Stagnicola traski	0	4		4			1	1			S1				G2	S1														21	
1	IMGASL6010	Giant Columbia River limpet	Fisherola nuttall	0	3		3			1	1			S2		C		G2	S2	1,2	a	1,2,3			T							T	21	RP 1995f (Snake River)
1	IMGASM0060	Rotund physa	Physella columbiana	0	0		0			1	1			G2				G2							T								21	
1	IMGASM0080	Olive physa	Physella cooperi	0	4		4			1	1			S1				G3	S1														21	
1	IMGASM0150	Grain physa	Physella hordacea	0	4		4			1	1			S1				G1	S1														21	
1	IMGASM0190	Twisted physa	Physella lordi	0	4		4			1	1			S1				G5	S1														21	
1	IMGASM0310	Sunset physa	Physella virginea	0	0		0			1	1			G2				G2															21	
1	IMGASM5020	Star gyro	Gyraulus crista	0	4		4			1	1			S1				G5	S1														21	
1	IMGASN0030	Coarse rams-horn	Planorbella binney	0	4		4			1	1			S1				G4	S1														21	
1	IMGASN1010	Sharp sprite	Promenetus exacuous	0	4		4			1	1			S1				G5	S1														21	
1	IMGASN1020	Umbilicate sprite	Promenetus umbilicatellus	0	3		3			1	1			S2				G4	S2														21	
1	IMGASR3010	Newcomb's littorine snail	Algamorda newcombiana	0	4		4			1	1			S1		C	Co	G1	S1	1,2	a	6		T									21	MR 1995, RP 2004f
1	IMGASV2040	Northern abalone	Haliotis kamtschatkana	0	16	5	3	3	5	9	2	3	4	C		C				1,2,3	a	4,6			T								28, 29, 30, 31	
1	IMGASX0010	Pristine springsnail	Pristinicola hemphill	0	0		0			1	1																					T	21	

APPENDIX 2:

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA										STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions							
COMMON NAME (Genetic Diversity Unit)	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current risk	Socio-economic value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	WHROW HABITAT COMMENTS
Ozette Sockeye	Oncorhynchus nerka	1	**16**	3	5	3	5	**4**	2	1	1	C	G5/T2	T	21
Lower Dungeness Pink Salmon	Oncorhynchus gorbuscha	1	**16**	5	3	3	5	**5**	3	1	1		S2		21, 28, 29, 30, 31, 32
Upper Dungeness Pink Salmon	Oncorhynchus gorbuscha	1	**16**	5	3	3	5	**5**	3	1	1		S2		21, 28, 29, 30, 31, 32
Mid-Columbia Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Snake River Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Upper Columbia Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	E	21, 28, 29, 30, 31, 32
Mid-Columbia Coho	Oncorhynchus kisutch	1	**16**	5	5	3	3	**7**	3	2	2		G4		21, 28, 29, 30, 31, 32
Yakima Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**7**	3	1	3		G5/T2		21, 28, 29, 30, 31, 32
Lower Columbia Steelhead	Oncorhynchus mykiss	1	**15**	4	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Lake Pleasant Sockeye	Oncorhynchus nerka	1	**14**	3	3	3	5	**3**	1	1	1		G5/T3		21
Lower Columbia Coho	Oncorhynchus kisutch	1	**14**	3	5	3	3	**6**	3	1	2		G4/T2	C	21, 28, 29, 30, 31, 32
South Puget Sound Steelhead	Oncorhynchus mykiss	1	**14**	4	4	3	3	**6**	2	1	3		S5		21, 28, 29, 30, 31, 32
North Puget Sound Steelhead	Oncorhynchus mykiss	1	**13**	3	4	3	3	**6**	2	1	3		S5		21, 28, 29, 30, 31, 32
Upper Columbia Fall Chinook	Oncorhynchus tshawytscha	1	**13**	4	3	3	3	**7**	2	2	3		G5/T1		21, 28, 29, 30, 31, 32
Below Bonneville Fall Chum	Oncorhynchus keta	0	**18**	5	5	3	5	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Grays River Fall Chum	Oncorhynchus keta	0	**18**	5	5	3	5	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Eastern Strait of Juan de Fuca Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Lower Columbia Tule Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Mid- and Lower Columbia Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Mid-Columbia Tule Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Fork Nooksack Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
S Puget Snd, Hood Canal & Snohomish Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Snake River Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
South Fork Nooksack Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
South Puget Sound Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA									STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions						
COMMON NAME (Genetic Diversity Unit)	**SCIENTIFIC NAME**	**SGCN**	**Y-Axis**	Threats	Current risk	Socio-economic value	Vulnerability	**X-Axis**	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	**WHROW HABITAT COMMENTS**
Stillaguamish & Skagit Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Upper Columbia Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		E	21, 28, 29, 30, 31, 32
Mid-Columbia and Snake Fall Chinook	Oncorhynchus tschawytscha	0	**15**	4	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Discovery Bay/Sequim Bay Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Hood Canal Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Okanogan Sockeye	Oncorhynchus nerka	0	**14**	5	1	3	5	**8**	3	2	3				21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Wenatchee Sockeye	Oncorhynchus nerka	0	**14**	5	1	3	5	**8**	3	2	3				21, 28, 29, 30, 31, 32
Chehalis Spring Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lk Washington Beach Spawners Sockeye	Oncorhynchus nerka	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Spring Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Fall Chum	Oncorhynchus keta	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Western Strait of Juan de Fuca Fall Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lower Columbia Bright Fall Chinook	Oncorhynchus tschawytscha	0	**11**	4	1	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
South Coast Fall Chinook	Oncorhynchus tschawytscha	0	**11**	3	2	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Upper Columbia Summer Chinook	Oncorhynchus tschawytscha	0	**11**	4	1	3	3	**10**	3	2	5				21, 28, 29, 30, 31, 32
Southwest Washington Steelhead	Oncorhynchus mykiss	0	**10**	2	2	3	3	**6**	2	1	3				21, 28, 29, 30, 31, 32
North Coast Steelhead	Oncorhynchus mykiss	0	**10**	1	3	3	3	**7**	3	1	3				21, 28, 29, 30, 31, 32
Baker Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Central Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Central/South Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Fraser Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Hood Canal Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Hood Canal Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lk Washington River Spawners Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Nisqually Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA									STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions						
COMMON NAME (Genetic Diversity Unit)	**SCIENTIFIC NAME**	**SGCN**	**Y-Axis**	Threats	Current risk	Socio-economic value	Vulnerability	**X-Axis**	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	**WHROW HABITAT COMMENTS**
Nooksack Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Puyallup Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Quinault Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Snohomish Even-Year Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Coast Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Summer Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Winter Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Fall Chum	Oncorhynchus keta	0	**9**	3	0	3	3	**3**	1	1	1				21, 28, 29, 30, 31, 32
Fraser Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**7**	2	2	3				21, 28, 29, 30, 31, 32
North Coast Fall Chinook	Oncorhynchus tschawytscha	0	**9**	2	1	3	3	**7**	2	2	3				21, 28, 29, 30, 31, 32
Hood Canal Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3			C	21, 28, 29, 30, 31, 32
South Coast Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3			C	21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32

APPENDIX 3: CRITERIA FOR RANKING SPECIES OF GREATEST CONSERVATION NEED

WASHINGTON CWCS SPECIES RANKING CRITERIA

<table>
<tr><th>FACTOR</th><th>CRITERIA</th><th>NOTES</th></tr>
<tr><td colspan="3">CONSERVATION CONCERNS – The HIGHER the score, the HIGHER the priority</td></tr>
<tr><td>THREATS</td><td>Number of threats
Irreversibility, immediacy of threats
Rank 1 through 5

1 = Low threat
3 = Medium threat
5 = High threat

Threats are to be considered for WA only unless species is migratory and has a known limiting factor outside the state.</td><td>Threats are defined as human-caused impacts.

WA state actions may not be restricted to addressing threats within the state. For example, funds might be used to attend international conferences for the conservation of a particular species.

A species with different threats in different regions can be treated as different species in the matrix, i.e. western meadowlark (westside) and western meadowlark (eastside)</td></tr>
<tr><td>CURRENT STATUS</td><td>Degree of concern (WDFW listings, NHP global and state rankings).
Automatically calculated in spreadsheet using assigned values for each rank.

<table>
<tr><th colspan="2">WDFW</th><th colspan="2">NHP</th></tr>
<tr><td>E</td><td>3</td><td>G1</td><td>3</td></tr>
<tr><td>T</td><td>3</td><td>G2</td><td>3</td></tr>
<tr><td>S</td><td>2</td><td>G3</td><td>2</td></tr>
<tr><td>C</td><td>2</td><td>G4</td><td>1</td></tr>
<tr><td>M</td><td>1</td><td>G5</td><td>0</td></tr>
<tr><td></td><td></td><td>S1</td><td>3</td></tr>
<tr><td></td><td></td><td>S2</td><td>3</td></tr>
<tr><td></td><td></td><td>S3</td><td>2</td></tr>
<tr><td></td><td></td><td>S4</td><td>1</td></tr>
<tr><td></td><td></td><td>S5</td><td>0</td></tr>
</table>
</td><td>Where a species has dual rankings, the ranking of highest concern was chosen for consideration.

Number values for each rank were assigned by expert judgment.

Species with too little information for ranking (i.e. GU or SU) were not assigned a value. Expert judgment will be needed on a species-by-species basis.

Rank 1 through 3

1 = Low status
2 = Medium status
3 = High status</td></tr>
<tr><td>SOCIO/ ECONOMIC VALUE</td><td>Rank 1 through 3

1 = Low value
2 = Medium value
3 = High value</td><td>Cultural icon (i.e. tribal)
Commercial/game species
Non-consumptive recreational
Flagship species
Keystone species
Indicator species</td></tr>
<tr><td>VULNERABLE</td><td>Rank 1 through 5

1 = Low vulnerability
3 = Medium vulnerability
5 = High vulnerability</td><td>Vulnerability is defined through elements of life history.

Reproductive mechanisms
Scale of endemism
Specialist
Restricted distribution
Peripheral range (breeding vs. non)</td></tr>
</table>

FACTOR	CRITERIA	NOTES
CONSERVATION ACTIONS – The LOWER the score, the HIGHER the priority		
KNOWLEDGE	**Adequate knowledge to manage species in the state of Washington.** 1 = Low knowledge in WA 2 = Medium knowledge in WA 3 = High knowledge in WA	Knowledge of species applicable to Washington populations. Example: Consider ecological relationships, limiting factors, population dynamics.
EXPENDITURES	**Non-SWG sources of funding available or being used** 1 = Inadequate 2 = Partly adequate 3 = Mostly adequate	Based on what you know, give us your opinion. Example: 1 = <$50K 2 = $50K - $500K 3 = >$500K
ADEQUACY OF CONSERVATION MEASURES IN PLACE	**Amount of current protection related to species need:** 1 = Inadequate 3 = Partly adequate 5 = Mostly adequate	Consider the following: Regulation Planning efforts Acquisition Easement Population manipulation Enforcement/compliance Education Community involvement/concern Mitigation

EXAMPLE of Conservation Measures for the spotted owl: **Resulting score would be a 3.**

CONSERVATION MEASURES	INADEQUATE	PARTLY ADEQUATE	MOSTLY ADEQUATE
Regulation		x	
Planning efforts		x	
Acquisition		x	
Easement		--	
Population manipulation	x		
Enforcement/compliance	x		
Education		x	
Community involvement/concern		x	
Mitigation	x		

APPENDIX 4: CWCS OUTREACH PLAN

Communications will be continual and outreach will be opportunistic throughout the project, but there are three primary phases or points of contact with agencies, NGOs and the public which are being built in to the CWCS planning process.

1. **Initial Outreach:** Informs our various internal and external publics of the overall SWG program, including the EAs and CWCS project, and how our partners and the public can be involved in the development of the CWCS. Started with a briefing for the EMT and Fish and Wildlife Commission in December 2003 and continues with presentations to groups and various other outreach opportunities. Includes:

    - Development of a dynamic PowerPoint, CWCS outline and timeline (2003).
    - Development of a CWCS website and two full-color brochures, one for the CWCS and one for the overall SWG program (February 2004).
    - Creation of, and regular meetings with, an internal steering committee and external advisory committees (see attached CWCS committee lists).
    - Presentations to the various WDFW standing advisory committees, including the Game Advisory Council (12/13/03), Lands Advisory Council (3/27/04), and the Wildlife Diversity Advisory Council (4/24/04). These standing councils include representatives from many statewide conservation groups and they will hopefully serve as a venue to get the word out/back to these groups.
    - Presentation on EAs and CWCS process at the midwinter Wildlife Diversity Workshop
    - Presentations to Audubon Washington, The Nature Conservancy, WWRC, NW Land Trust Alliance and other wildlife conservation organizations, as opportunities arise.
    - Briefings/meetings with the Fish and Wildlife Service, USDA Forest Service and other federal agencies at their request (Spring 2004).
    - Briefings/meetings with the Washington State Assn of Counties, Washington Forest Protection Assn, and key agricultural contacts.
    - A briefing for key Congressional staff as part of March 2004 trip to Washington DC.
    - Coordination meetings with Yakama Indian Nation, Colville Confederated Tribes, and other tribes that manage large tracts of wildlife habitat, as well as smaller tribes. Work closely with Tribal Liaison Dick Stone and with WDFW Regional Directors on tribal outreach efforts.
    - A “heads up” letter from Director Koenings to all WDFW employees (May, 2004).
    - An article in the WDFW employees’ newsletter (Fall 2004).
    - Development of a CWCS link on the WDFW website (April 2004).
    - Meeting with Assistant Directors and Regional Directors on April 29 in Hyak to review CWCS process relative to Ecoregional Assessments, Subbasin Planning, Shared Salmon Strategy and other ongoing planning processes.

2. **Draft Strategy Review:** A second round of coordination and public involvement when we have a draft CWCS to review. A partial review of some components of the strategy such as species and habitat lists will also be done as we go along, by internal and external steering and advisory committees. Review will include:

    - Briefings for EMT, Regional Directors and Fish and Wildlife Commission.

- Follow-up meetings with many of the same groups and agencies as in the initial outreach phase, as well as agriculture and other groups not contacted in the initial outreach phase.
- A WDFW press release to outdoor media (June 1, 2005).
- A round of regional informational meetings to review the draft CWCS with regional stakeholders; work closely with the Regional Directors in setting up these meetings (June, 2005).
- Briefings for Governor's staff and key legislators.

3. **Post-submittal Outreach and Publicity:** Once the CWCS is submitted to and accepted by the U.S. Fish and Wildlife Service, WDFW should develop an 8 to 12-page Executive Summary and entertain a third round of outreach to the outdoor media and our various publics. The focus would be on the final CWCS and how it lays out the future course of wildlife conservation in Washington. This third round of outreach would have a number of advantages: it would let our various publics see how we used their input on the draft plan (if we did); it would give us another shot at people we missed with the draft strategy; it would give the outdoor media something shorter and more polished-looking (Executive Summary) to feature in stories; and it puts the final plan in the hands of people who can help address the resource problems identified in the strategy.

Other outreach and coordination efforts:

4. **Technical Development and Review:** Development of our Species of Greatest Conservation Need (SGCN) list and associated habitats, as well as statewide and ecoregional conservation strategies. Includes:

    - Participation in the WDFW's Ecoregional Assessment (EA) oversight committee to ensure close coordination with the EA products and the CWCS; close coordination with the EA and county planning elements of the overall SWG program.
    - Convening of ad-hoc species and habitat review committees consisting of wildlife taxa experts from WDFW, WDNR and groups such as Audubon Washington. Follow-up meetings with Harriet Allen and her staff to refine the SGCN matrix.
    - Meetings with Paul Ashley (Region 1) and David Johnson to develop ways to incorporate the subbasin planning and WHROW processes into the CWCS.

5. **National and Regional Coordination:** The International Association of Fish and Wildlife Agencies (IAFWA) and the US Fish and Wildlife Service (FWS) have initiated national and regional coordination efforts. These efforts have direct benefits for all concerned and we will participate in both national and regional coordination efforts. Defenders of Wildlife, The Nature Conservancy, and other national conservation groups will also participate in these efforts. Director Koenings will represent WAFWA on the National Advisory and Acceptance Team (NAAT) for the CWCS.

    - National coordination meetings with IAFWA, FWS, OWP and other state wildlife agencies. Includes meetings in Burnet, Texas, Washington, DC (March 2004), Spokane (April 2004), and Nebraska City, (August 2004).
    - Monthly coordination conference calls with FWS Region 1 and state conservation strategy coordinators in Region 1 states (February 2004).
    - Bimonthly meetings in the Vancouver/Portland area with FWS, Defenders of Wildlife, The Nature Conservancy, and conservation strategy coordinators from Idaho and Oregon.

APPENDIX 5: MAJOR CONSERVATION PROGRAMS AND PARTNERS

Audubon Washington
Defenders of Wildlife
Cascade Land Conservancy
Ducks Unlimited, Inc.

Indian Tribes

- Chehalis Confederated Tribe
- Colville Confederated Tribes
- Cowlitz Indian Tribe
- Hoh Indian Tribe
- Jamestown S'Klallam Tribe
- Kalispel Indian Community
- Lower Elwha Klallam Indian Tribe
- Lummi Nation
- Makah Indian Tribe
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of Indians
- Quileute Indian Tribe
- Quinault Indian Nation
- Samish Tribe
- Sauk-Suiattle Indian Tribe
- Shoalwater Bay Tribe
- Skokomish Tribe
- Spokane Tribe
- Squaxin Island Indian Tribe
- Stillaguamish Indian Tribe
- Suquamish Tribe
- Swinomish Indian Tribal Community
- Tulalip Tribes
- Upper Skagit Tribe
- Yakama Nation

Intermountain West Joint Venture
Lower Columbia Fish Recovery Board
National Park Service
National Resources Conservation Service
Northwest Habitat Institute
Northwest Land Trusts
Northwest Power and Conservation Council
Pacific Coast Joint Venture
Partners in Flight
People for Puget Sound
Puget Sound Action Team
Snake River Salmon Recovery Board
The Nature Conservancy of Washington
The Rocky Mountain Elk Foundation
Upper Columbia Salmon Recovery Board

U.S. Bureau of Land Management
U.S. Bureau of Reclamation

USDA Forest Service
- Colville National Forest
- Gifford Pinchot National Forest
- Mount Baker-Snoqualmie National Forest
- Okanogan National Forest
- Olympic National Forest
- Umatilla National Forest
- Wenatchee National Forest

U.S. Department of Defense
- U.S. Army (Yakima Training Center)
- U.S. Navy (Puget Sound bases)
- U.S. Air Force (McChord and Fairchild AFBs)

U.S. Fish and Wildlife Service
- Columbia National Wildlife Refuge
- Conboy National Wildlife Refuge
- Copalis National Wildlife Refuge
- Dungeness National Wildlife Refuge
- Flattery Rocks National Wildlife Refuge
- Franz Lake National Wildlife Refuge
- Grays Harbor National Wildlife Refuge
- Hanford Reservation
- Julia B. Hansen National Wildlife Refuge
- Little Pend Oreille National Wildlife Refuge
- McNary National Wildlife Refuge
- Nisqually National Wildlife Refuge
- Pierce National Wildlife Refuge
- Protection Island National Wildlife Refuge
- Quillayute Needles National Wildlife Refuge
- Ridgefield National Wildlife Refuge
- Saddle Mountain National Wildlife Refuge
- San Juan Islands National Wildlife Refuge
- Steigerwald Lake National Wildlife Refuge
- Toppenish National Wildlife Refuge
- Turnbull National Wildlife Refuge
- Willapa National Wildlife Refuge

Washington Conservation Districts
Washington Department of Agriculture
Washington Department of Ecology
Washington Department of Natural Resources
- Washington Natural Heritage Program
- Natural Areas Program

Washington Department of Transportation
Washington Farm Forestry Association
Washington Forest Protection Association
Washington Sea Grant

Washington State Association of Counties

- Adams County
- Asotin County
- Benton County
- Chelan County
- Clallam County
- Clark County
- Columbia County
- Cowlitz County
- Douglas County
- Ferry County
- Franklin County
- Garfield County
- Grant County
- Grays Harbor County
- Island County
- Jefferson County
- King County
- Kitsap County
- Kittitas County
- Klickitat County
- Lewis County
- Lincoln County
- Mason County
- Okanogan County
- Pacific County
- Pend Oreille County
- Pierce County
- San Juan County
- Skagit County
- Skamania County
- Snohomish County
- Spokane County
- Stevens County
- Thurston County
- Wahkiakum County
- Walla Walla County
- Whatcom County
- Whitman County
- Yakima County

Washington State Conservation Commission
Washington State Parks and Recreation Commission
Washington Water Resources Association
Yakima County
Yakima Salmon Recovery Board

Washington Priority Habitats and Species List

The Priority Habitats and Species (PHS) List is a catalog of those species and habitat types identified by the Washington Department of Fish and Wildlife (WDFW) as priorities for management and preservation. Because information on fish, wildlife, and their habitats is dynamic, the PHS List is updated periodically.

The PHS List is a catalog of habitats and species considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species. A Priority habitat may consist of a unique vegetation type or dominant plant species, a described successional stage, or a specific structural element.

There are 18 habitat types, 140 vertebrate species, 28 invertebrate species, and 14 species groups currently on the PHS List. These constitute about 16 percent of Washington's approximately 1,000 vertebrate species and a fraction of the state's invertebrate fauna. Mapping of priority habitats and species was initiated in 1990 and includes about two-thirds of Washington's 43 million acres. The remaining third generally involves federal and tribal lands. Mapping consists of recording locational and descriptive data in a Geographic Information System (GIS). These GIS databases represent WDFW's best knowledge of fish and wildlife resources and occurrences. It is important to note, however, that priority species or priority habitats may occur in areas not currently known to WDFW biologists or in areas for which comprehensive surveys have not been conducted. Site-specific surveys may be necessary to rule out the presence of priority habitats or species on individual sites.

Included in the PHS system of databases are WDFW's PHS Points and Polygon Databases, StreamNet, and the Wildlife Heritage Database. Other information sources include the Department of Natural Resources Aquatic Lands Division database on kelp beds and the U.S. Fish and Wildlife Service's information on the National Wetlands Inventory (NWI).

Questions and requests for additional PHS information may be directed to:

Priority Habitats and Species
WDFW Habitat Program
600 Capitol Way N.
Olympia WA 98501-1091

Internet Access:
The PHS internet home page can be accessed via the World Wide Web at:
www.wa.gov/wdfw/hab/phspage.htm

Washington Natural Heritage Program

The Washington Natural Heritage Program (WNHP) was established by the State Legislature and placed within the Washington Department of Natural Resources (WDNR) in 1982. The main objectives of establishing the program were 1) to develop and maintain an objective classification of the state's species and ecosystems, 2) to develop an inventory of the locations of priority species and ecosystems, 3) to use the information to help guide the development of a statewide system of natural areas, and 4) to share the information with agencies, organizations and individuals for environmental assessment and land management purposes.

Since its establishment, the WNHP has been gathering information on rare species and both rare and common ecosystems. The WNHP maintains the primary statewide information system on rare plant species, managing information on more than 350 species of rare plants and more than 5,000 locations of those species statewide. The WNHP also has information and expertise on select groups of rare animal species. The WNHP zoologists work cooperatively with WDFW zoologists on individual projects and on setting species priorities. The WNHP's vegetation ecologists are responsible for the development and maintenance of the statewide ecosystems classification used in ecoregional assessments and other conservation planning purposes.

The Washington Natural Heritage Information System is a major source of information for individuals, agencies and organizations engaged in land use planning and decision making. During the recently concluded biennium (2003-2005), the WNHP provided information to more than 1,000 private companies, local governments, state and federal agencies, conservation organizations and educational institutions.

The WNHP is a member of a network of similar programs throughout the western hemisphere. The network, NatureServe, has member programs in all 50 states, all Canadian provinces, and several Latin American and Caribbean nations. All programs use the same basic methodology and data management tools to assess rarity and for setting conservation priorities. This allows for improved sharing of information and consistency of conservation efforts across political boundaries.

Questions and requests for additional information regarding WNHP can be directed to:

Washington Natural Heritage Program
Department of Natural Resources
PO Box 47014, Olympia, WA 98504-7014
(360) 902-1661 or (360) 902-1667

The WNHP home page can be accessed via the Internet at:
http://www.dnr.wa.gov/inhp/index.html

Additional information about NatureServe is available via the Internet at:
http://www.natureserve.org

Interactive Biodiversity Information System

IBIS is an informational resource developed by the Northwest Habitat Institute (NHI) to promote the conservation of Northwest fish, wildlife, and their habitats through education and the distribution of timely, peer-reviewed scientific data.

IBIS contains extensive information about Pacific Northwest fish, wildlife, and their habitats, but more noteworthy, IBIS attempts to reveal and analyze the relationships among these species and their habitats. NHI hopes to make the IBIS web site a place where students, scientists, resource managers or any other interested user can discover and analyze these relationships without having to purchase special software (such as geographic information systems) or hassle with the integration of disparate data sets. IBIS will, however, provide downloadable data for users who desire to perform more advanced analyses or to integrate their own data sets with IBIS data. Finally, NHI sees IBIS as not only a fish, wildlife, and habitat information distribution system but also as a peer-review system for species data. We acknowledge that in a system as extensive as IBIS, there are going to be errors as well as disagreement among scientists regarding the attributes of species and their relationships. NHI encourages IBIS users to provide feedback so we may correct errors and discuss discrepancies.

The IBIS web site is in the early stages of development; however, NHI staff, with the support of many project partners, has been developing the data for over five years. The IBIS database was initially developed by NHI for Oregon and Washington during the Wildlife-Habitat Types in Oregon and Washington project. IBIS data is currently being refined and extended to include all of Idaho, Oregon, Washington, and the Columbia River Basin portions of Montana, Nevada, Utah and Wyoming. IBIS will eventually include species range maps, wildlife-habitat maps, extensive species-habitat data queries, and interactive wildlife-habitat mapping applications allowing dynamic spatial queries for the entire Pacific Northwest as previously defined.

Internet Access:

The IBIS Internet Home Page can be accessed via the World Wide Web at:
http://www.nwhi.org/ibis/home/ibis.asp

Questions about IBIS may be directed to:
The Northwest Habitat Institute
P.O. Box 855
Corvallis, OR 97339
Phone:(541)753-2199
Fax:(541)753-2440
habitat@nwhi.org

Washington GAP Analysis Program

The Washington GAP Analysis Program (GAP) is a nation-wide program currently administered by the Biological Resources Division of the US Geological Survey (BRD-USGS; formerly the National Biological Service [NBS]). The overall goal of GAP Analysis is to identify elements of biodiversity that lack adequate representation in the nation's network of reserves (i.e., areas managed primarily for the protection of biodiversity). GAP Analysis is a coarse-filter approach to biodiversity protection. It provides an overview of the distribution and conservation status of several components of biodiversity, with particular emphasis on vegetation and terrestrial vertebrates. Digital map overlays in a Geographic Information System (GIS) are used to identify vegetation types, individual species, and species-rich areas that are unrepresented or underrepresented in existing biodiversity management areas. GAP Analysis functions as a preliminary step to more detailed studies needed to establish actual boundaries for potential additions to the existing network of reserves.

The primary filter in GAP Analysis is vegetation type (defined by the Washington GAP Analysis Project as the composite of actual vegetation, vegetation zone, and ecoregion). Vegetation types are mapped and their conservation status evaluated based on representation on biodiversity management areas, conversion to human-dominated landscapes, and spatial context. Vegetation is used as the primary filter in GAP Analysis because vegetation patterns are determinants of overall biodiversity patterns (Levin 1981, Noss 1990, Franklin 1993). It is impractical to map the distributions of all plants and animals, but GAP Analysis makes the assumption that if all vegetation types are adequately represented in biodiversity management areas, then most plant and animal species will also be adequately represented. The second major GAP Analysis filter is composed of information on the distribution of individual species. This filter can be used to identify individual species that lack adequate protection and, when individual species maps are overlaid, areas of high species richness. In most states, including Washington, vertebrates are the only taxa mapped because there is relatively little information available for other taxa, and because vertebrates currently command the most attention in conservation issues.

The following are general limitations of GAP Analysis; specific limitations for particular datasets are described in the appropriate sections:

GAP Analysis data are derived from remote sensing and modeling to make general assessments about conservation status. Any decisions based on the data must be supported by ground-truthing and more detailed analyses.

GAP Analysis is not a substitute for the listing of threatened and endangered species and associated recovery efforts. A primary argument in favor of GAP Analysis is that it is proactive in recognizing areas of high biodiversity value for the long-term maintenance of populations of native species and natural ecosystems before individual species and plant communities become threatened with extinction. A goal of GAP Analysis is to reduce the rate at which species require listing as threatened or endangered.

The static nature of the GAP Analysis data limits their utility in conservation risk assessment. Our database provides a snapshot of a region in which land cover and land ownership are dynamic and where trend data would be especially useful.

GAP Analysis is not a substitute for a thorough national biological inventory. As a response to rapid habitat loss, GAP Analysis is intended to provide a quick assessment of the distribution of vegetation and associated species before they are lost and to provide focus and direction for local, regional, and national efforts to maintain biodiversity. The process of

improving knowledge in systematics, ecology, and distribution of species is lengthy and expensive. That process must be continued and expedited in order to provide the detailed information needed for a comprehensive assessment of the nation's biodiversity.
GAP Analysis is a coarse-filter approach. The network of Conservation Data Centers (CDC) and Natural Heritage Programs established cooperatively by The Nature Conservancy and various state agencies maintain detailed databases on the locations of rare elements of biodiversity. Conservation of such elements is best accomplished through the fine-filter approach of the above organizations. It is not the role of GAP to duplicate or disseminate Natural Heritage Program or CDC Element Occurrence Records. Users interested in more specific information about the location, status, and ecology of populations of such species are directed to their state Natural Heritage Program or CDC.

Internet Access:
The Washington GAP Analysis Internet Home Page can be accessed via the World Wide Web at: http://www.fish.washington.edu/naturemapping/waGAP/public_html/index.html

Questions about the Washington GAP Analysis Project may be directed to:
Washington Cooperative Fish and Wildlife Research Unit
University of Washington Box 355020
Seattle, WA 98195-5020
(206)543-6475

Partners in Flight

Partners in Flight was launched in 1990 in response to growing concerns about declines in the populations of many land bird species, and in order to emphasize the conservation of birds not covered by existing conservation initiatives. The initial focus was on Neotropical migrants, species that breed in the Nearctic (North America) and winter in the Neotropics (Central and South America), but the focus has spread to include most landbirds and other species requiring terrestrial habitats. The central premise of Partners in Flight (PIF) has been that the resources of public and private organizations in North and South America must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. Partners in Flight is a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. All Partners in Flight meetings at all levels are open to anyone interested in bird conservation.

Partners in Flight's goal is to focus resources on the improvement of monitoring and inventory, research, management, and education programs involving birds and their habitats. The PIF strategy is to stimulate cooperative public and private sector efforts in North America and the Neotropics to meet these goals.

Bird Conservation Planning Information

One of the primary activities being conducted by Partners in Flight - U.S. is the development of bird conservation plans for the entire continental United States.

The Flight Plan

The guiding principles for PIF bird conservation planning can be found in the Partners in Flight
bird conservation strategy, The Flight Plan. It is composed of four parts:
(1) setting priorities
(2) establishing objectives
(3) conservation action
(4) evaluation.

Physiographic Areas

The spatial unit chosen by Partners in Flight for planning purposes is the physiographic area. There are 58 physiographic areas wholly or partially contained within the contiguous United States and several others wholly or partially in Alaska. Partners in Flight bird conservation plans in the West use state boundaries as their first sorting unit for planning, with each plan internally arranged by physiographic area or habitat type.

Integrated Bird Conservation

A common spatial language can greatly enhance the potential for communication among conservation initiatives. Under the auspices of the North American Bird Conservation Initiative (NABCI), Partners in Flight worked with the North American Waterfowl Management Plan, the Unites States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan, as well as with counterparts in Mexico and Canada, to develop a standard map of planning regions to be shared by all initiatives. These Bird Conservation Regions are intended to serve as planning, implementation, and evaluation units for integrated bird conservation for the entire continent. Future revisions of PIF Bird Conservation Plans will begin to utilize Bird Conservation Regions as the planning units, facilitating integration with planning efforts of the other initiatives.

Species Assessment

An important component in The PIF Flight Plan is the identification of priority species. PIF recognized that existing means of setting conservation priorities did not capture the complexities and needs of birds. The PIF Species Assessment process uses the best of traditional methods modified by our knowledge of bird biology to create a scientifically credible means of prioritizing birds and their habitat. It is a dynamic method that uses several criteria to rank a species' vulnerability. Numerical scores are given for each criterion, with higher scores reflecting higher vulnerability. The most vulnerable species are those with declining population trends, limited geographic ranges, and/or deteriorating habitats.

PIF Watch List

The Partners in Flight Watch List was developed using the Species Assessment to highlight those birds of the continental United States, not already listed under the Endangered Species Act, that most warrant conservation attention. There is no single reason why all of these birds are on the list. Some are relatively common but undergoing steep population declines; others are rare but actually increasing in numbers. The Watch List is not intended to drive local conservation agendas, which should be based on priorities identified within each physiographic area.

Species Account Resources

Species accounts that synthesize scientific literature on the life histories and effects of management practices on particular bird species are available from a variety of sources.

Bird Conservation Plans Summary Document

The development of Bird Conservation Plans is a complicated process. More detailed information about the PIF Bird Conservation Planning Process and PIF Bird Conservation Plans is provided in the recent PIF publication - Partners in Flight: Conservation of the Land Birds of the United States.

Internet Access:

The Partners in Flight Internet Home Page can be accessed via the World Wide Web at: http://www.partnersinflight.org/

National Wetland Inventory

The National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. The National Wetlands Inventory Center information is used by Federal, State, and local agencies, academic institutions, U.S. Congress, and the private sector. The NWIC has mapped 90 percent of the lower 48 states, and 34 percent of Alaska. About 44 percent of the lower 48 states and 13 percent of Alaska are digitized. Congressional mandates require the NWIC to produce status and trends reports to Congress at ten-year intervals. In addition to status and trends reports, the NWIC has produced over 130 publications, including manuals, plant and hydric soils lists, field guides, posters, wall size resource maps, atlases, state reports, and numerous articles published in professional journals.

The NWI National Center in St. Petersburg, Florida, includes a state-of-the-art computer operation which is responsible for constructing the wetlands layer of the National Spatial Data Infrastructure. Digitized wetlands data can be integrated with other layers of the NSDI such as natural resources and cultural and physical features, leading to production of selected color and customized maps of the information from wetland maps, and the transfer of digital data to users and researchers world-wide. Dozens of organizations, including Federal, State, county agencies, and private sector organizations such as Ducks Unlimited, have supported conversion of wetland maps into digital data for computer use. Statewide databases have been built for 9 States and initiated in 5 other States. Digitized wetland data are also available for portions of 37 other States. Once a digital database is constructed, users can obtain the data at no cost over the Internet, or through the U.S. Geological Survey for the cost of reproduction.

NWI maintains a MAPS database of metadata containing production information, history, and availability of all maps and digital wetlands data produced by NWI. This database is available over the Internet.

The Emergency Wetlands Resources Act requires that NWI archive and disseminate wetlands maps and digitized data as it becomes available. The process prescribed by Office of Management and Budget (OMB) Circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data", provides an avenue for increased NWI coordination activities with other Federal agencies to reduce waste in government programs. As chair of the Federal Geographic Data Committee's Wetlands Subcommittee, the NWI Project Leader is responsible for promoting the development, sharing, and dissemination of wetlands related spatial data. The Secretary of the Interior chairs the Federal Geographic Data Committee. NWI continues to coordinate mapping activities under 36 cooperative agreements or memoranda of understanding. NWI is involved in training and providing technical assistance to the public and other agencies.

NWI maps and digital data are distributed widely throughout the country and the world. NWI has distributed over 1.7 million maps nationally since they were first introduced. Map distribution is accomplished through Cooperator-Run Distribution centers.

Users of NWI maps and digital data are as varied as are the uses. Maps are used by all levels of government, academia, Congress, private consultants, land developers, and conservation organizations. The public makes extensive use of NWI maps in a myriad of applications including planning for watershed and drinking water supply protection; siting of transportation corridors; construction of solid waste facilities; and siting of schools and other municipal buildings. Resource managers in the Service and the States are provided with maps which are essential for effective habitat management and acquisition of

important wetland areas needed to perpetuate migratory bird populations as called for in the North American Waterfowl and Wetlands Management Plan; for fisheries restoration; floodplain planning; and endangered species recovery plans. Agencies from the Department of Agriculture use the maps as a major tool in the identification of wetlands for the administration of the Swampbuster provisions of the 1985 and 1990 Farm Bills. Regulatory agencies use the maps to help in advanced wetland identification procedures, and to determine wetland values and mitigation requirements. Private sector planners use the maps to determine location and nature of wetlands to aid in framing alternative plans to meet regulatory requirements. The maps are instrumental in preventing problems from developing and in providing facts that allow sound business decisions to be made quickly, accurately, and efficiently. Good planning protects the habitat value of wetlands for wildlife, preserves water quality, provides flood protection, and enhances ground water recharge, among many other wetland values.

Additional sources of data are maintained by the Service to complement the information available from the maps themselves. The Service maintains a National List of Vascular Plant Species that Occur in Wetlands. This list is referenced in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, and in the Natural Resources Conservation Service's procedures to identify wetlands for the Swampbuster provision of the Farm Bill. The recent report on wetlands by the National Academy of Sciences found the National List to be scientifically sound and recommended that the Service continue development of the list. The Service has developed a protocol to allow other agencies and private individuals to submit additions, deletions, or changes to the list. The National List and Regional Lists are available over the Internet through the NWI Homepage.
NWI digital data have been available over the Internet since 1994. In the first year alone 93,000 data files were distributed through anonymous file transfer protocol (FTP) access to wetland maps digital line graph (DLG) data. To date, over 250,000 electronic copies of wetland maps are in the hands of resource managers and the general public. One-third of the digital wetlands files downloaded off Internet went to government agencies at Federal, State, Regional, and local levels. Other users include commercial enterprises, environmental organizations, universities, and the military. Users from 25 countries from Estonia to New Zealand to Chile obtained NWI maps from the Internet. This excellent partnership provides information to any government, private, or commercial entity that requires assistance to address issues throughout the world.

The National Wetlands Inventory Internet Home Page can be accessed via the World Wide Web at: http://wetlands.fws.gov/

Ecoregional Assessments

Ecoregional Assessments (EAs) are the product of a partnership between TNC and WDFW. Other major contributors to EAs are the natural heritage programs in Washington and Oregon. Ecoregional Assessments also have benefited from the participation of many other scientists and conservation experts as team members and expert reviewers. EAs use an approach developed by TNC (Groves *et al*. 2000; Groves *et al.* 2002; Groves 2003) and other scientists to establish long-term conservation priorities within the natural boundaries of ecoregions. "First iteration' or first edition assessments have been completed for over 45 of the 81 ecoregions in the U.S., and for several others outside the U.S, with the objective of completing assessments throughout the U.S. (and in many parts of Canada and other countries) by 2008. The Nature Conservancy is leading a number of these assessments, while others are led by partner organizations or agencies using the same basic methodology.

Overview of the EA Process

The EA process follows the basic steps described below. An EA may devise innovations where necessary to address specific data limitations or other challenges they confronted.

1. Identify conservation targets – Conservation targets are those elements of biodiversity – plants, animals, plant communities, habitat types, etc. – that are included in the analysis. Targets are selected to represent the full range of biodiversity in the ecoregion and to include any species of special concern.

Robert Jenkins, working for TNC in the 1970s, developed the concept of 'coarse filter' and 'fine filter' conservation targets for use in conservation planning (Jenkins 1996; Noss 1987). This approach hypothesizes that conservation of all communities and ecological systems (coarse filter targets) will also conserve the majority of species that occupy them. This coarse filter strategy is a way to compensate for the lack of detailed information on the vast number of poorly-studied invertebrates and other species.

Fine filter targets are those species or natural communities which can not be assumed to be represented in a conservation plan simply by including the full range of coarse filter targets. Fine filter targets warrant a special effort to ensure they are conserved. These are typically rare or imperiled species or natural community types, but can include wide-ranging species, ecoregional endemic species, species that are ecoregionally disjunct, or keystone species.

2. Assemble information on the target locations and occurrence quality – Data are assembled on target occurrences from a variety of sources. Although existing agency databases make up the bulk of this data set, data gaps are often filled by gathering previously scattered information and consulting specialists for specific target groups.

3. Determine how to represent and rank target occurrences – Decisions are made regarding the best way to describe and map occurrences of each target. Targets may be represented as points for specific locations, such as rare plant population locations, or polygons to show the areal extent of coarse filter targets. In addition, the quality of each occurrence is ranked where possible using the NatureServe element occurrence ranking system (NatureServe and TNC 2000). The data are stored in a Geographical Information System (GIS).

4. Set representation levels for each target – The analytical tool used for ecoregional assessments requires representation levels or "goals" for how many populations or how much habitat area must be conserved to sustain each target over time. These

"goals" are used to drive the next step of the process: selection of a portfolio of conservation areas. In reality, very few targets are sufficiently understood to allow scientists to estimate with a high degree of confidence the number and distribution of occurrences that will be sufficient to ensure survival. It is essential that users of ECAs recognize this limitation. The goals do not correspond to sufficient conditions for long-term survival of species. They do, however, function as analytical tools for assembling an efficient portfolio of conservation areas that captures multiple examples of the ecoregion's biodiversity. These goals also provide a metric for gauging the progress of biodiversity conservation in the ecoregion over time.

There is another more profound reason for not setting conservation goals in a scientific assessment. Conservation goals are a policy choice that should based on societal values. Policy choices are the responsibility of those entrusted to make them: agency directors, stakeholder commissions, county commissioners, the legislature, etc. This assessment was conducted by scientists, not policy makers. Our use of goals is not a policy statement. The "goals" are simply an analytical device for mapping important places for conservation.

5. Rate the suitability of assessment units – An ecoregion is divided into thousands of "assessment units." The assessment units can be based on watersheds, a cadastral system, or a regular rectangular or hexagonal grid. Each of these units is compared to the others using a set of factors related to suitability for conservation. Suitability is roughly equivalent to the likelihood of conservation success. Suitability encompasses surrogates for habitat quality, such as road density or the extent of developed areas, as well as factors likely to influence conservation feasibility, such as proximity to urban areas, the proportion of private lands, or the existence of established conservation areas (Davis *et al*. 1996).

It is important to note that the factors chosen for this "suitability index" strongly influence selection of conservation areas, i.e., a different set of factors can result in a different portfolio. Also, some factors in the suitability index cross into what is traditionally a policy arena. For example, setting the index to favor the selection of existing public over private land presumes a policy of using existing public lands to meet goals wherever possible; thereby minimizing the involvement of private or tribal lands.

6. Assemble a draft portfolio – An EA entails hundreds of different targets existing at thousands of widely distributed locations. The relative biodiversity value and relative conservation suitability of thousands of potential conservation areas must be evaluated. This complexity of information precludes simple inspection by experts to arrive at the most efficient, yet comprehensive, set of conservation areas. Hence, EAs use an optimal site selection algorithm known as SITES. Developed for The Nature Conservancy by the National Center for Ecological Analysis and Synthesis, SITES is computer software that aids scientists in identifying an efficient set of conservation areas. It uses a computational algorithm developed at the University of Adelaide, Australia.

To use SITES, one must input data describing the biodiversity at and the conservation suitability of the thousands of assessment units in the ecoregion. The number of targets, condition of targets, and rarity of targets present at a particular place determines the biodiversity of the unit. Conservation suitability is input as a suitability index (described above) representing a set of weighted factors chosen to represent the relative likelihood of successful conservation at a unit. The relative weighting of each of these factors is determined by the scientists conducting the assessment.

SITES strives to minimize an objective function. It begins by selecting a random set of hexagons, i.e., a random conservation portfolio. Next, SITES iteratively explores

improvements to this random portfolio by randomly adding or removing other units. At each iteration, the new portfolio is compared with the previous portfolio and the better one is accepted. The algorithm uses a method called simulated annealing (Kirkpatrick *et al*. 1983) to reject sub-optimal portfolios, thus greatly increasing the chances of converging on most efficient portfolio. Typically, the algorithm is run for 1 to 2 million iterations.

Keep in mind that SITES is a decision support tool. That is, it cannot generate the ultimate conservation portfolio. Expert review and revision are necessary to compensate for gaps in the input data or other limitations of this automated part of the portfolio development process. 7. Refine the Portfolio Through Expert Review – The assessment teams and additional outside experts review the draft portfolio to correct errors of omission or inclusion by the computer-driven site selection process. These experts also assist the teams with refining individual site boundaries.

Strengths and Limitations of EAs

EAs are a resource for planners and others interested in the status or conservation of the biological diversity of an ecoregion. EAs improve on the informational resources previously available in several ways:

• EAs are conducted at an ecoregional scale. It provides information for decisions and activities that occur at an ecoregional scale: establishing regional priorities for conservation action; coordinating programs for species or habitats that cross state, county, or other political boundaries; judging the regional importance of any particular site in the ecoregion; and measuring progress in protecting the full biodiversity of the ecoregion.

• In order to prepare an EA, diverse data sources are drawn together into a single system. Terrestrial species and habitat information is brought together as an integrated planning resource. Expert input has been gathered, reviewed by other experts, and documented. This database is available for ongoing analyses, continued improvement of the data themselves, and application to other natural resource questions.

• An EA tells us which areas contribute the most to the conservation of existing biodiversity. It provides a baseline to measure conservation progress over time as we continue to improve our understanding of the ecosystems and species we hope to conserve. At the same time, it is important to recognize the limitations of EAs and to understand how they should be utilized. Users should be mindful of the following:

• An EA has no regulatory authority. It is simply a guide for conservation action across the ecoregion. As a guide with no regulatory authority, a portfolio is intrinsically flexible. A portfolio should not constrain decision makers in how they address local land use and conservation issues. Since many types of land use are compatible with biodiversity conservation, the large number and size of conservation areas creates numerous options for local conservation of biodiversity. Ultimately, the management or protection of the conservation priority areas will be based on the policies and values of local governments, organizations, and citizens. Decision makers should use this guide to inform their choices.

• Sites or “priority conservation areas” described in an EA are not intended to be dominated by parks or nature reserves set aside from economic activity. While some areas may require such protection, most can and will accommodate multiple uses as determined by landowners, local communities and appropriate agencies.

• An EA is one of many science-based tools that will assist conservation efforts by government agencies, non-governmental organizations, and individuals. It cannot

replace, for example, recovery plans for endangered species, or the detailed planning required to design a local conservation project. It does not address the special considerations of salmon or game management, and so, for example, cannot be used to ensure adequate populations for harvest.

• EAs are an ecoregion-scale assessment. Therefore, a conservation portfolio will not include many places that are significant for the conservation of local biodiversity, such as small wetlands, riparian areas, cliffs, and small, high-quality patches of common habitat types. Due the spatial scale of an assessment, some conservation priority areas may include places that are poorly suited for conservation. Also, the boundaries ascribed to sites in a portfolio may not coincide to boundaries drawn with higher resolution data. For this reason, local assessments will be necessary and are encouraged.

• A conservation portfolio should not be used as a guide for siting restoration projects. Priority conservation areas include high-quality habitat that must be maintained as well as lower quality habitat that will require restoration. But they are not the only sites in the ecoregion that merit restoration, whether for rebuilding habitat for imperiled species, increasing salmon or game abundance, improving water quality, or other community objectives.

APPENDIX 6: SGCN WILDLIFE SPECIES PLANS

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APPENDIX 7: SGCN SALMON PLANS AND STRATEGIES

An Outline For Salmon Recovery Planshttp://wdfw.wa.gov/recovery/recovery_model.htm

Bull Trout and Dolly Varden Management Plan http://wdfw.wa.gov/fish/bulltrt/bulldoly.htm

Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout *(Salvelinus confluentus)* http://pacific.fws.gov/bulltrout/jcs/documents/PugetSdpt1.pdf

Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan (draft) http://www.hccc.cog.wa.us/about.htm

Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (draft) http://www.nwr.noaa.gov/1srd/Recovery/domains/willow/WMU_Plan/WMU_Plan_files.html#vol1

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Pacific Coastal Salmon Recovery Fund (NOAA) http://www.nwr.noaa.gov/pcsrf/index.htm

Pacific Coastal Salmon Recovery Program (NWIFC) http://www.nwifc.wa.gov/recovery/documents/coastalrecovery.pdf

Pacific Fishery Management Council, Salmon Fishery Management Plan http://www.pcouncil.org/salmon/salfmp.html

Pacific Salmon Commission http://www.psc.org/Index.htm

Puget Sound Action Plan 2005-2007 Puget Sound Conservation and Recovery Plan http://www.psat.wa.gov/Publications/priorities_05/Priorities_05_review.htm

Puget Sound Comprehensive Chinook Management Plan http://wdfw.wa.gov/fish/papers/ps_chinook_management/harvest/index.htm

Puget Sound Salmon Recovery Plan (draft) http://www.sharedsalmonstrategy.org/plan/index.htm

Puget Sound Shared Salmon Strategy http://www.sharedsalmonstrategy.org

Reference Guide to Salmon Habitat Conservation at the Watershed Level. http://www.governor.wa.gov/gsro/publications/watershed/reference.pdf

Regional Fisheries Enhancement Group http://wdfw.wa.gov/volunter/rfeg/rfeg_outcomes.htm

Roadmap for Salmon Habitat Conservation at the Watershed Level http://www.governor.wa.gov/gsro/publications/watershed/roadmap.pdf

Salmon & Steelhead Habitat Inventory & Assessment Project (SSHIAP) http://wdfw.wa.gov/hab/sshiap/

Salmon and Steelhead Stock Inventory (SaSSI) http://wdfw.wa.gov/fish/sassi/sassi.htm

Salmon Recovery Funding Board http://www.iac.wa.gov/srfb/default.asp

Salmon Recovery Plans (2003)
http://wdfw.wa.gov/recovery/salmon_recovery_plan_model_jun03.pdf

Snake River Salmon Recovery Plan for SE Washington (draft)
http://www.snakeriverboard.org/pdf_files/DraftPubSummary06005.pdf

South Puget Sound Salmon Recovery Plan
http://home.comcast.net/%7Esouthsoundsalmon/home.htm

Statewide Strategy to Recover Salmon: Extinction is Not an Option
http://www.governor.wa.gov/gsro/strategy/strategy.htm
The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (Columbia River Inter-Tribal Fish Commission)
http://www.critfc.org/text/trp.html

Upper Columbia Salmon Recovery Board, A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region (2003)
http://www.co.chelan.wa.us/nr/data/biological_strategy_2003.pdf

Upper Columbia Salmon Recovery Plan (draft)
http://okanogancounty.org/water/salmon%20recovery;%20draft%20review%20corner.htm

USFWS Pacific Region: Fisheries Program Strategic Plan 2004-2006
http://pacific.fws.gov/Fisheries/Docs/Pacific%20Region%20Step%20Down%20Plan.pdf

Washington Department of Ecology Watershed Planning
http://www.ecy.wa.gov/watershed/index.html

Watershed (WRIA) Planning for Salmon Habitat http://dnr.metrokc.gov/Wrias/

WDFW Salmon Recovery http://wdfw.wa.gov/recovery.htm

WDFW Watershed Stewardship Team http://wdfw.wa.gov/hab/wst.htm

Yakima Subbasin Salmon Recovery Plan (draft)
http://www.co.yakima.wa.us/yaksubbasin/Library/ExecutiveSummary.pdf

APPENDIX 8: ASSOCIATED HABITATS OF CONSERVATION CONCERN

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed-Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Westside Grasslands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Open Water
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands
- Coastal Dunes and Beaches
- Bays and Estuaries
- Inland Marine Deeper Waters
- Marine Nearshore and Shelf

The following priority habitat descriptions and photos are excerpted from *Wildlife Habitat Relationships in Oregon and Washington*.

Westside Lowlands Conifer-Hardwood Forest

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This forest habitat occurs throughout low-elevation western Washington, except on extremely dry or wet sites. The global distribution extends from southeastern Alaska south to southwestern Oregon.

Physical Setting. Climate is relatively mild and moist to wet. Mean annual precipitation is mostly 35-100 inches, but can vary locally. Snowfall ranges from rare to regular, but is transitory. Summers are relatively dry. Summer fog is a major factor on the outer coast in the Sitka spruce zone. Elevation ranges from sea level to a maximum of about 2,000 ft in much of northern Washington. Soils and geology are very diverse. Topography ranges from relatively flat glacial till plains to steep mountainous terrain.

Landscape Setting. This is the most extensive habitat in the lowlands on the west side of the Cascades, and forms the matrix within which other habitats occur as patches, especially Westside Riparian-Wetlands and less commonly Herbaceous Wetlands or Open Water. It also occurs adjacent to or in a mosaic with Urban and Mixed Environs (hereafter Urban) or Agriculture, Pasture and Mixed Environs (hereafter Agriculture) habitats. In the driest areas, it occurs adjacent to or in a mosaic with Westside Oak and Dry Douglas-fir Forest and Woodlands. Bordering this habitat at upper elevations is Montane Mixed Conifer Forest. Along the coastline, it often occurs adjacent to Coastal Dunes and Beaches. The primary land use for this habitat is forestry.

Structure. This habitat is forest, or rarely woodland, dominated by evergreen conifers, deciduous broadleaf trees, or both. Late seral stands typically have an abundance of large (>164 ft tall) coniferous trees, a multi-layered canopy structure, large snags, and many large logs on the ground. Early seral stands typically have smaller trees, single-storied canopies, and may be dominated by conifers, broadleaf trees, or both. Coarse woody debris is abundant in early seral stands after natural disturbances but much less so after clearcutting. Forest understories are structurally diverse: evergreen shrubs tend to dominate on nutrient-poor or drier sites; deciduous shrubs, ferns, and/or forbs tend to dominate on relatively nutrient-rich or moist sites. Shrubs may be low (1.6 ft tall), medium-tall (3.3- 6.6 ft), or tall (6.6-13.1 ft). Almost all structural stages are represented in the successional sequence within this habitat. Mosses are often a major ground cover. Lichens are abundant in the canopy of old stands.

Composition. Western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*) are the most characteristic species and 1 or both are typically present. Most stands are dominated by 1 or more of the following: Douglas-fir, western hemlock, western redcedar (*Thuja plicata*), Sitka spruce (Picea sitchensis), red alder (Alnus rubra), or bigleaf maple (Acer macrophyllum). Trees of local importance that may be dominant include shore pine (*Pinus contorta* var. *contorta*) on stabilized dunes, and grand fir (*Abies grandis*) in drier climates. Western white pine (*Pinus monticola*) is frequent but subordinate in importance through much of this habitat. Pacific silver fir (*Abies amabilis*) is largely absent except on the wettest low-elevation portion of the western Olympic Peninsula, where it is common and sometimes co-dominant. Common small subcanopy trees are cascara buckthorn (*Rhamnus purshiana*) in more moist climates and Pacific yew (*Taxus brevifolia*) in somewhat drier climates or sites. Sitka spruce is found as a major species only in the outer coastal area at low elevations where summer fog is a significant factor. Bigleaf maple is most abundant in the Puget Lowland, but occurs elsewhere also. Douglas-fir is absent to uncommon as a native species in the very wet maritime outer coastal area of Washington, including the coastal plain on the west side of the Olympic Peninsula. However, it has been extensively planted in that area. Paper birch (*Betula papyrifera*) occurs as a codominant only in Whatcom County, Washington. Grand fir occurs as an occasional co-dominant only in the Puget Lowland. Dominant or co-dominant understory shrub species of more than local importance include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), vine maple (*Acer circinatum*), Pacific rhododendron (*Rhododendron macrophyllum*), salmonberry (*Rubus spectabilis*), trailing blackberry (R. ursinus), red elderberry (Sambucus racemosa), fools huckleberry (*Menziesia ferruginea*), beargrass (*Xerophyllum tenax*), oval-leaf huckleberry (*Vaccinium ovalifolium*), evergreen huckleberry (*V. ovatum*), and red huckleberry (*V. parvifolium*). Salal and rhododendron are particularly associated with low nutrient or relatively dry sites. Swordfern (*Polystichum munitum*) is the most common herbaceous species and is often dominant on nitrogen-rich or moist sites. Other forbs and ferns that frequently dominate the understory are Oregon oxalis (*Oxalis oregana*), deer fern (*Blechnum spican*t), bracken fern (*Pteridium aquilinum)*, vanilla leaf (*Achlys triphylla*), twinflower (*Linnaea borealis*), false lily-of-the-valley (*Maianthemum dilatatum*), western spring beauty (*Claytonia siberica*), foamflower (*Tiarella trifoliata*), inside-out flower (*Vancouveria hexandra*), and common whipplea (*Whipplea modesta*).

Other Classifications and Key References. This habitat includes most of the forests and their successional seres within the *Tsuga heterophylla* and *Picea sitchensis* zones. This habitat is also referred to as Douglas-fir-western hemlock and Sitka spruce-western hemlock forests, spruce-cedar-hemlock forest and cedar-hemlock-Douglas-fir forest. The Washington GAP Vegetation map includes this vegetation as conifer forest, mixed hardwood/conifer forest, and hardwood forest in the Sitka spruce, western hemlock, Olympic Douglas-fir, Puget Sound Douglas-fir and Cowlitz River zones. A number of other references describe elements of this habitat.

Natural Disturbance Regime. Fire is the major natural disturbance in all but the wettest climatic area (Sitka spruce zone), where wind becomes the major source of natural disturbance. Natural fire-return intervals generally range from about 100 years or less in the driest areas to several hundred years. Mean fire-return interval for the western hemlock zone as a whole is 250 years, but may vary greatly. Major natural fires are associated with occasional extreme weather condition. Fires are typically high-severity, with few trees surviving. However, low- and moderate-severity fires that leave partial to complete live canopies are not uncommon, especially in drier climatic areas. Occasional major windstorms hit outer coastal forests most intensely, where fires are rare. Severity of wind disturbance varies greatly, with minor events being extremely frequent and major events occurring once every few decades. Bark beetles and fungi are significant

causes of mortality that typically operate on a small scale. Landslides are another natural disturbance that occur in some areas.

Succession and Stand Dynamics. After a severe fire or blowdown, a typical stand will be briefly occupied by annual and perennial forbs and grasses as well as pre-disturbance understory shrubs and herbs that resprout. Herbaceous species generally give way to dominance by shrubs or a mixture of shrubs and young trees within a few years. If shrubs are dense and trees did not establish early, the site may remain as a shrubland for an indeterminate period. Early seral tree species can be any of the potential dominants for the habitat, depending on environment, type of disturbance, and seed source. All of these species except the short-lived red alder are capable of persisting for at least a few hundred years. Douglas-fir is the most common dominant after fire, but is uncommon in the wettest zones. It is also the most fire resistant of the trees in this habitat and survives moderate-severity fires well. After the tree canopy closes, the understory may become sparse, corresponding with the stem-exclusion stage. Eventually tree density will decrease and the understory will begin to flourish again, typically at stand age 60-100 years. As trees grow larger and a new generation of shade-tolerant understory trees (usually western hemlock, less commonly western redcedar) grows up, a multi-layered canopy will gradually develop and be well expressed by stand age 200-400 years. Another fire is likely to return before the loss of shade-intolerant Douglas-fir from the canopy at stand age 800-1,000 years, unless the stand is located in the wet maritime zone. Throughout this habitat, western hemlock tends to increase in importance as stand development proceeds. Coarse woody debris peaks in abundance in the first 50 years after a fire and is least abundant at about stand age 100-200 years.

Effects of Management and Anthropogenic Impacts. Red alder is more successful after typical logging disturbance than after fire alone on moist, nutrient-rich sites, perhaps because of the species' ability to establish abundantly on scarified soils. Alder is much more common now because of large-scale logging activities. Alder grows more quickly in height early in succession than the conifers, thereby prompting many forest managers to apply herbicides for alder control. If alder is allowed to grow and dominate early successional stands, it will decline in importance after about 70 years and die out completely by age 100. Often there are suppressed conifers in the subcanopy that potentially can respond to the death of the alder canopy. However, salmonberry sometimes forms a dense shrub layer under the alder, which can exclude conifer regeneration. Salmonberry responds positively to soil disturbance, such as that associated with logging. Bigleaf maple sprouts readily after logging and is therefore well adapted to increase after disturbance as well. Clearcut logging and plantation forestry have resulted in less diverse tree canopies, and have focused mainly on Douglas-fir, with reductions in coarse woody

debris over natural levels, a shortened stand initiation phase, and succession truncated well before late-seral characteristics are expressed. Douglas-fir has been almost universally planted, even in wet coastal areas of Washington, where it is rare in natural stands.

Status and Trends. Extremely large areas of this habitat remain. Some loss has occurred, primarily to development in the Puget Lowland. Condition of what remains has been degraded by industrial forest practices at both the stand and landscape scale. Most of the habitat is probably now in Douglas-fir plantations. Only a fraction of the original old-growth forest remains, mostly in national forests in the Cascade and Olympic mountains. Areal extent continues to be reduced gradually, especially in the Puget Lowland. An increase in alternative silviculture practices may be improving structural and species diversity in some areas. However, intensive logging of natural-origin mature and young stands and even small areas of old growth continues. Of the 62 plant associations representing this habitat listed in the National Vegetation Classification, 27 percent are globally imperiled or critically imperiled.

Westside Oak and Dry Douglas-fir Forest and Woodlands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is primarily found in the Puget Lowlands ecoregion. It is common in and around the San Juan Islands and in parts of Thurston, Pierce and Mason counties. Minor occurrences can also be found in the northeastern Olympic Mountains and western Cascades. This habitat is composed of several geographic variants: California black oak and ponderosa pine are found in a small area of Pierce County. Shore pine is only important in San Juan and Mason counties. Dry Douglas-fir forests (without oak or madrone) are mainly in the Puget Lowland and rarely in the Olympic Mountains or west Cascades. Pacific madrone and Douglas-fir/Pacific madrone stands without oak are limited to the Puget Lowland foothills.

Physical Setting. This habitat typically occupies dry sites west of the Cascades. Annual mean precipitation ranges from 17 to 60 inches, occasionally higher. Elevation ranges from sea level to about 3,500 in the Olympic Mountains, but is mainly below 1,500 ft. Topography ranges from nearly level to very steep slopes, where aspect tends to be southern or western. Soils on dry sites are typically shallow over bedrock, very stony, or very deep and excessively drained. Parent materials include various types of bedrock, shallow or very coarse glacial till, alluvium, and glacial outwash.

Landscape Setting. This habitat is found in a mosaic with, or adjacent to, Westside Grasslands, Westside Lowlands Conifer-Hardwood Forest, Westside Riparian-Wetlands, Urban, and Agriculture. Inclusions of Open Water or Herbaceous Wetlands sometimes occur. In the Puget Lowland, this habitat is sometimes found adjacent to Puget Sound (Nearshore Marine). Land use of this habitat includes forestry (generally small scale), livestock grazing, and low-density rural residential.

Structure. This is a forest or woodland dominated by evergreen conifers, deciduous broadleaf trees, evergreen broadleaf trees, or some mixture of conifers and broadleaf trees. Canopy structure varies from single- to multi-storied. Large conifers, when present, typically emerge above broadleaf trees in mixed canopy stands. Large snags and logs are less abundant than in other westside forest habitats, but can be prominent, especially in unlogged old stands. Understories vary in structure: grasses, shrubs, ferns, or some combination will typically dominate. Deciduous broadleaf shrubs are perhaps most typical

as understory dominants in the existing landscape. Early successional stand structure varies depending on understory species present and if initiated following logging or fire.

Composition. The canopy is typically dominated by one or more of the following species: Douglas-fir (*Pseudotsuga menziesii*), Oregon white oak (*Quercus garryana*), Pacific madrone (*Arbutus menziesii*), shore pine (*Pinus contorta* var. *contorta*), or California black oak (*Q. kelloggii*). Grand fir (*Abies grandis*) is occasionally co-dominant with Douglas-fir in the northern Puget Lowlands. Oregon ash (*Fraxinus latifolia*) is occasionally co-dominant with white oak in riparian oak stands. Several other tree species may be present, but western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) generally cannot regenerate successfully because of dry conditions. This lack of shade-tolerant tree regeneration, along with understory indicators like tall Oregon grape (*Mahonia aquifolium*), and blue wildrye (*Elymus glaucus*), help distinguish dry Douglas-fir forests from mid-seral Douglas-fir stands on more mesic sites, which are part of the Westside Lowlands Conifer-Hardwood Forest. Tree regeneration, when present, is typically Douglas-fir, less commonly grand fir. Deciduous shrubs that commonly dominate or co-dominate the understory are oceanspray (*Holodiscus discolor*), baldhip rose (*Rosa gymnocarpa*), poison-oak (*Toxicodendron diversiloba*), serviceberry (*Amelanchier alnifolia*), beaked hazel (*Corylus cornuta*), trailing blackberry (*Rubus ursinus*), Indian plum (*Oemleria cerasiformis*), snowberries (*Symphoricarpos albus* and *S. mollis*), and oval-leaf viburnum (*Viburnum ellipticum*). Evergreen shrubs or vines that sometimes are dominant where conifers are important in the canopy include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), Pacific rhododendron (*Rhododendron macrophyllum*), hairy honeysuckle (*Lonicera hispidula*), evergreen huckleberry (*Vaccinium ovatum*), and Piper's barberry (*Mahonia piperiana*). Native graminoids that commonly dominate or co-dominate the understory was western fescue (*Festuca occidentalis*), Alaska oniongrass (*Melica subulata*), blue wildrye, and long-stolon sedge (*Carex inops*). Kentucky bluegrass (*Poa pratensis*) is a major non-native dominant in oak woodland understories. Swordfern (*Polystichum munitum*) or, less commonly, bracken fern (*Pteridium aquilinum*) sometimes co-dominates the understory, especially on sites that formerly supported grasslands and savannas. Forbs, many of which are characteristic of these dry sites, are often abundant and diverse, but typically do not dominate. Common camas (*Camassia quamash*), cleavers (*Galium aparine*), or other forbs are occasionally co-dominant with graminoids.

Other Classifications and Key References. This habitat has been described as oak groves and dry site Douglas-fir forest in the *Tsuga heterophylla* zone of western Washington. The Washington Gap Project represents this habitat as part of hardwood forest, mixed hardwood/conifer forest, and conifer forest in the Woodland/Prairie Mosaic, Puget Sound Douglas-fir, and to a minor degree, the Cowlitz River. Other references describe elements of this habitat.

Natural Disturbance Regime. Fire is the major natural disturbance in this habitat. In presettlement times, fire frequency probably ranged from frequent (every few years) to moderately frequent (once every 50-100 years) and reflected low-severity and moderate-severity fire regimes. Fire frequency has been much lower in the last 100 years. Windstorms are an occasional disturbance, most important in the San Juan Islands and vicinity. Understories are sometimes browsed heavily by deer in the San Juan Islands, thus preventing dominance by deciduous shrubs and favoring grasses and forbs.

Succession and Stand Dynamics. Many of these forests and woodlands were formerly either grasslands or savannas that probably burned frequently, thus preventing dominance by trees. Some portions of this habitat in the central Puget Lowlands may have formerly been dominated by shrubs (salal, beaked hazel, and evergreen huckleberry for lengthy periods, probably also because of the particular combination of fire frequency and intensity.

Other areas were woodlands to semi-open forests that burned moderately frequently, as evidenced by the relict stands of old-growth Douglas-fir. The dominant trees in this habitat establish most abundantly after fire. Moderate-severity fires kill many trees but also leave many alive, creating opportunities for establishment of new cohorts of tree sand increasing structural complexity. Oaks and madrone resprout after fire if they are top-killed. Without periodic fire, most oak-dominated stands will eventually convert to Douglas-fir forests. Animal dissemination of acorns may be important in dispersal of oaks. Shore pine, where present, is an early-seral upper canopy series that grows quickly and dies out after about 100-150 years, yielding to a mature Douglas-fir stand unless another fire intervenes before the death of the pine.

Effects of Management and Anthropogenic Impacts. Clearcut or similar logging reduces canopy structural complexity and abundance of large woody debris. Dry Douglas-fir stands are well suited to alternative silvicultural practices such as uneven-aged management or maintaining two-storied stands. Oaks and madrone will typically resprout after logging and thus can increase in importance relative to conifers in mixed canopy stands. Selective logging of Douglas-fir in oak stands can prevent long-term loss of oak dominance. with fire exclusion, stands have probably increased in tree density and grassy understories have been replaced by deciduous shrubs. Moderate to heavy grazing or other significant ground disturbance, especially in grassy understories, leads to increases in non-native invader species, many of which are now abundant in stands with grassy or formerly grassy understories. Scot's broom (*Cytisus scoparius*) is an exotic shrub particularly invasive and persistent in oak woodlands. Exotic herbaceous invaders include colonial bentgrass (*Agrostis capillaris*), common velvetgrass (*Holcus lanatus*), Kentucky bluegrass, tall oatgrass (Arrhenatherum elatius) rigid brome (*Bromus rigidus*), orchardgrass (*Dactylis glomerata*), hedgehog dogtail (*Cynosurus echinatus*), tall fescue (*Festuca arundinacea*), and common St. Johnswort (*Hypericum perforatum*).

Status and Trends. This habitat is relatively limited in area and is currently declining in extent and condition. With the cessation of regular burning 100-130 years ago, many grasslands and savannas were invaded by a greater density of trees and thus converted to a different habitat. Conversely, large areas of this habitat have been converted to Urban or Agriculture habitats. Most of what remains has been considerably degraded by invasion of exotic species or by logging and consequent loss of structural diversity. Ongoing threats include residential development, increase and spread of exotic species, and fire suppression effects (the latter especially in oak-dominated stands). Thirteen of 27 plant associations listed in the National Vegetation Classification are considered globally imperiled or critically imperiled.

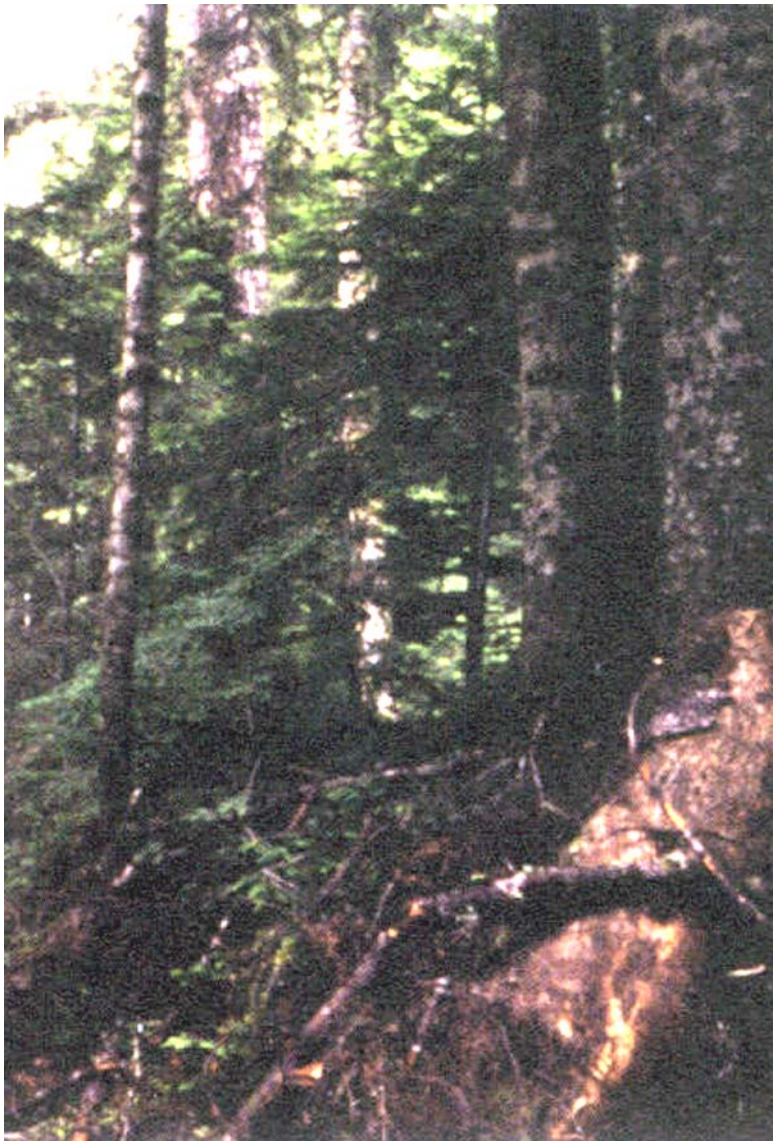
Montane Mixed Conifer Forest

Christopher B. Chappell

Geographic Distribution. These forests occur in mountains throughout Washington, including the Cascade Range, Olympic Mountains, Okanogan Highlands, Coast Range (rarely), and Blue Mountains.

Physical Setting. This habitat is typified by a moderate to deep winter snow pack that persists for 3 to 9 months. The climate is moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 40 inches to >200 inches. Elevation is mid to upper montane, as low as 2,000 ft in northern Washington. On the west side, it occupies an elevational zone of about 2,500 to 3,000 vertical feet, and on the eastside it occupies a narrower zone of about 1,500 vertical feet. Topography is generally mountainous. Soils are typically not well developed, but varied in their parent material: glacial till, volcanic ash, residuum, or colluvium. Spodosols are common.

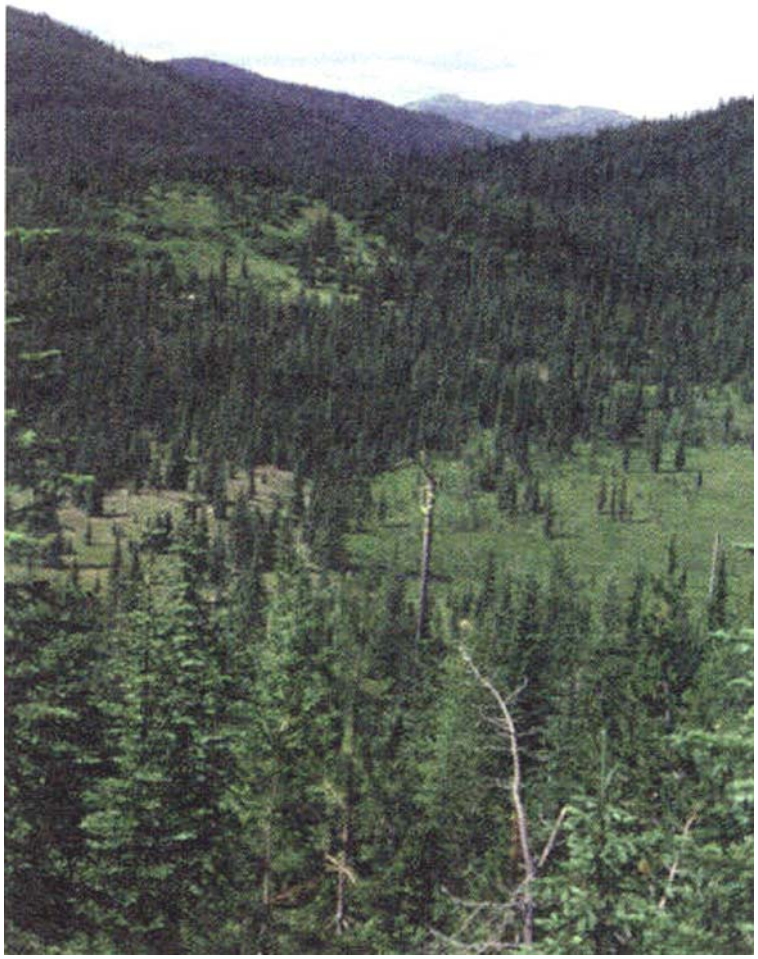
Landscape Setting. This habitat is found adjacent to Westside Lowlands Conifer-Hardwood Forest or Eastside Mixed Conifer Forests to Subalpine Parkland at its upper elevation limits. Inclusions of Montane Forested Wetlands, Westside Riparian Wetlands, and less commonly Open Water or Herbaceous Wetlands occur within the matrix of montane forest habitat. The typical land use is forestry or recreation. Most of this type is found on public lands managed for timber values, and much of it has been harvested in a dispersed patch pattern.



Structure. This is a forest, or rarely woodland, dominated by evergreen conifers. Canopy structure varies from single- to multi-storied. Tree size also varies from small to very large. Large snags and logs vary from abundant to uncommon. Understories vary in structure: shrubs, forbs, ferns, graminoids or some combination of these usually dominate, but they can be depauperate as well. Deciduous broadleaf shrubs are most typical as understory dominants. Early successional structure after logging or fire varies depending on understory species present. Mosses are a major ground cover and epiphytic lichens are typically abundant in the canopy.

Composition. This forest habitat is recognized by the dominance or prominence of one of the following species: Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), subalpine fir (*A. lasiocarpa*), Engelmann spruce (*Picea engelmannii*), noble fir (*A. procera*), or Alaska yellow-cedar (*Chamaecyparis nootkatensis*). Several other trees may co-dominate: Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*). Tree regeneration is typically dominated by Pacific silver fir in moist westside middle-elevation zones; by mountain hemlock, sometimes with silver fir, in cool, very snowy zones on the west side and along the Cascade Crest and by subalpine fir in cold, drier eastside zones. Subalpine fir and Engelmann spruce are major species only east of the Cascade Crest in Washington, in the Blue Mountains ecoregion, and in the northeastern Olympic Mountains (spruce is largely absent in the Olympic Mountains). Lodgepole pine is important east of the Cascade Crest. Douglas-fir is important east of the Cascade Crest and at lower elevations on the west side. Pacific silver fir is a major species on the west side. Noble fir, as a native species, is found primarily in the western Cascades in central Washington. Mountain hemlock is a common dominant at higher elevations along the Cascade Crest and to the west. Western hemlock, and to a lesser degree western redcedar, occur as dominants primarily with silver fir at lower elevations on the west side. Alaska yellow-cedar occurs as a co-dominant west of the Cascade Crest in Washington. Deciduous shrubs that commonly dominate or co-dominate the understory are oval-leaf huckleberry (*Vaccinium ovalifolium*), big huckleberry (*V. membranaceum*), grouseberry (*V. scoparium*), dwarf huckleberry (*V. cespitosum*), fools huckleberry (Menziesia ferruginea), Cascade azalea (*Rhododendron albiflorum*), devil's-club (*Oplopanax horridus*), and, in the far south only, baldhip rose (*Rosa gymnocarpa*), currants (*Ribes* spp.), and creeping snowberry (*Symphoricarpos mollis*). Important evergreen shrubs include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), Pacific rhododendron (*Rhododendron macrophyllum*), and beargrass *(Xerophyllum tenax*). Deer fern (*Blechnum spicant*) and western oak fern (*Gymnocarpium dryopteris)* are commonly co-dominant. The most abundant forbs include Oregon oxalis (*Oxalis oregana*), single-leaf foamflower (*Tiarella trifoliata* var*. unifoliata*), rosy twisted-stalk (*Streptopus roseus)*, queen's cup (*Clintonia uniflora*), western bunchberry (*Cornus unalaschkensis*), twinflower (*Linnaea borealis*), prince's pine (*Chimaphila umbellata*), five-leaved bramble (*Rubus pedatus*), and dwarf bramble (*R. lasiococcus*), avalanche lily (*Erythronium montanum*), Sitka valerian (*Valeriana sitchensis*), and false lily-of-the-valley (*Maianthemum dilatatum*).

Other Classifications and Key References. This habitat includes most of the upland forests and their successional stages, except lodgepole pine dominated forests, in the *Tsuga mertensiana*, *Abies amabilis, A. magnifica* var. *shastensis, A. lasiocarpa* zones of Franklin and Dyrness. Portions of this habitat have also been referred to as *A. amabilis-Tsuga heterophylla* forests, *A. magnifica* var. *shastensis* forests, and T*suga mertensiana* forests. It is equivalent to most of the conifer forest in the Silver Fir, Mountain Hemlock, and Subalpine Fir Zones of Washington GAP. Other references describe elements of this habitat.



Natural Disturbance Regime. Fire is the major natural disturbance in this habitat. Fire regimes are primarily of the high-severity type, but also include the moderate-severity regime (moderately frequent and highly variable) for Shasta red fir forests. Mean fire-return intervals vary greatly, from 800 years for some mountain hemlock-silver fir forests to about 40 years for red fir forests. Windstorms are a common small-scale disturbance and occasionally result in stand replacement. Insects and fungi are often important small-scale disturbances. However, they may affect larger areas also, for example, laminated root rot (*Phellinus weirii*) is a major natural disturbance, affecting large areas of mountain hemlock forests in the Oregon Cascades.

Succession and Stand Dynamics. After fire, a typical stand will briefly be occupied by annual and perennial ruderal forbs and grasses, as well as pre-disturbance understory shrubs and herbs that resprout. Stand initiation can take a long time, especially at higher elevations, resulting in shrub/herb dominance (with or without a scattered tree layer) for extended periods. Early seral tree species can be any of the potential dominants for the habitat, or lodgepole pine, depending on the environment, type of disturbance, and seed source. Fires tend to favor early seral dominance of lodgepole pine, Douglas-fir, noble fir, or Shasta red fir, if their seeds are present 1. In some areas, large stand-replacement fires will result in conversion of this habitat to the Lodgepole Pine Forest and Woodland habitat, distinguished by dominance of lodgepole. After the tree canopy closes, the understory typically becomes sparse for a time. Eventually tree density will decrease and the understory will begin to flourish again, but this process takes longer than in lower elevation forests, generally at least 100 years after the disturbance, sometimes much longer. As stand development proceeds, relatively shade-intolerant trees (lodgepole pine, Douglas-fir, western hemlock, noble fir, Engelmann spruce) typically decrease in importance and more shade-tolerant species (Pacific silver fir, subalpine fir, mountain hemlock) increase. Complex multi-layered canopies with large trees will typically take at least 300 years to develop, often much longer, and on some sites may never develop. Tree growth rates, and therefore the potential to develop these structural features, tend to decrease with increasing elevation.

Effects of Management and Anthropogenic Impacts. Forest management practices, such as clearcutting and plantations, have in many cases resulted in less diverse tree canopies with an emphasis on Douglas-fir. They also reduce coarse woody debris compared

to natural levels, and truncate succession well before late-seral characteristics are expressed. Post-harvest regeneration of trees has been a perpetual problem for forest managers in much of this habitat. Planting of Douglas-fir has often failed at higher elevations, even where old Douglas-fir were present in the unmanaged stand. Slash burning often has negative impacts on productivity and regeneration. Management has since shifted away from burning and toward planting noble fir or native species, natural regeneration, and advance regeneration. Noble fir plantations are now fairly common in managed landscapes, even outside the natural range of the species. Advance regeneration management tends to simulate wind disturbance but without the abundant downed wood component. Shelterwood cuts are a common management strategy in Engelmann spruce or subalpine fir stands.

Status and Trends. This habitat occupies large areas of the region. There has probably been little or no decline in the extent of this type over time. Large areas of this habitat are relatively undisturbed by human impacts and include significant old-growth stands. Other areas have been extensively affected by logging, especially dispersed patch clearcuts. The habitat is stable in area, but is probably still declining in condition because of continued logging. This habitat is one of the best protected, with large areas represented in national parks and wilderness areas. The only threat is continued road building and clearcutting in unprotected areas. None of the 81 plant associations representing this habitat listed in the National Vegetation Classification is considered imperiled.

Eastside (Interior) Mixed Conifer Forest

Rex C. Crawford

Geographic Distribution. The Eastside Mixed Conifer Forest habitat appears primarily in the Blue Mountains, East Cascades, and Okanogan Highland ecoregions of Washington. Douglas-fir-ponderosa pine forests occur along the eastern slope of the Cascades, the Blue Mountains, and the Okanogan Highlands. Grand fir-Douglas-fir forests and western larch forests are widely distributed throughout the Blue Mountains and, lesser so, along the east slope of the Cascades south of Lake Chelan and in the eastern Okanogan Highlands. Western hemlock-western redcedar-Douglas-fir forests are found in the Selkirk Mountains of eastern Washington, and on the east slope of the Cascades south of Lake Chelan to the Columbia River Gorge.

Physical Setting. The Eastside Mixed Conifer Forest habitat is primarily mid-montane with an elevation range of between 1,000 and 7,000 ft, mostly between 3,000 and 5,500 ft. Parent materials for soil development vary. This habitat receives some of the greatest amounts of precipitation in the inland northwest, 30-80 inches/year. Elevation of this habitat varies geographically, with generally higher elevations to the east.

Landscape Setting. This habitat makes up most of the continuous montane forests of the inland Pacific Northwest. It is located between the subalpine portions of the Montane Mixed Conifer Forest habitat in eastern Washington and lower tree line Ponderosa Pine and Forest and Woodlands.

Structure. Eastside Mixed Conifer habitats are montane forests and woodlands. Stand canopy structure is generally diverse, although single-layer forest canopies are currently more common than multi-layered forests with snags and large woody debris. The tree layer varies from closed forests to more open-canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. Tall shrubs, low shrubs, forbs or any combination may dominate stands. Deciduous shrubs typify shrub layers. Prolonged canopy closure may lead to development of a sparsely vegetated undergrowth.

Composition. This habitat contains a wide array of tree species (9) and stand dominance patterns. Douglas-fir (*Pseudotsuga menziesii*) is the most common tree species in this

habitat. It is almost always present and dominates or co-dominates most overstories. Lower elevations or drier sites may have ponderosa pine (Pinus ponderosa) as a co-dominant with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir (*Abies grandis*), western redcedar (*Thuja plicata*) and/or western hemlock (*Tsuga heterophylla*) are dominant or co-dominant with Douglas-fir. Other conifers include western larch (*Larix occidentalis*) and western white pine (*Pinus monticola*) on mesic sites, Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), and subalpine fir (Abies lasiocarpa) on colder sites. Rarely, Pacific yew (*Taxus brevifolia*) may be an abundant undergrowth tree or tall shrub. Undergrowth vegetation varies from open to nearly closed shrub thickets with 1 to many layers. Throughout the eastside conifer habitat, tall deciduous shrubs include vine maple (*Acer circinatum*) in the Cascades, Rocky Mountain maple (*A. glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), mallowleaf ninebark (*Physocarpus malvaceus*), and Scouler's willow (*Salix scouleriana*) at mid- to lower elevations. Medium-tall deciduous shrubs at higher elevations include fools huckleberry (*Menziesia ferruginea*), Cascade azalea (*Rhododendron albiflorum*), and big huckleberry (*Vaccinium membranaceum*). Widely distributed, generally drier site mid-height to short deciduous shrubs include baldhip rose (*Rosa gymnocarpa*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus, S. mollis*, and *S. oreophilus*). Low shrubs of higher elevations include low huckleberries (*Vaccinium cespitosum*, and *V. scoparium*) and five-leaved bramble (*Rubus pedatus*). Evergreen shrubs represented in this habitat are chinquapin (*Castanopsis chrysophylla*), a tall shrub in southeastern Cascades, low to mid-height dwarf Oregon grape (*Mahonia nervosa* in the east Cascades and *M. repens* elsewhere), beargrass (*Xerophyllum tenax*), and kinnikinnick (*A. uva-ursi*).Herbaceous broadleaf plants are important indicators of site productivity and disturbance. Species generally indicating productive sites include western oak fern (*Gymnocarpium dryopteris*), vanilla leaf (*Achlys triphylla*), wild ginger (*Asarum caudatum*), queen's cup (*Clintonia uniflora*), goldthread (*Coptis occidentalis*), false bugbane (*Trautvetteria caroliniensis*), windflower (*Anemone oregana, A. piperi, A. lyallii*), Hooker's fairybells (*Disporum hookeri*), Sitka valerian (*Valeriana sitchensis*), and pioneer violet (*Viola glabella*). Other indicator forbs are dogbane (*Apocynum androsaemifolium*), false solomonseal (*Maianthemum stellata*), heartleaf arnica (*Arnica cordifolia*), several lupines (*Lupinus caudatus, L. latifolius, L. argenteus* ssp. argenteus var. *laxiflorus*), western meadowrue (*Thalictrum occidentale*), rattlesnake plantain (*Goodyera oblongifolia*), skunkleaf polemonium (*Polemonium pulcherrimum*), trailplant (*Adenocaulon bicolor*), twinflower (*Linnaea borealis*), western starflower (*Trientalis latifolia*), and several wintergreens (*Pyrola asarifolia, P. picta, Orthilia secunda*). Graminoids are common in this forest habitat. Columbia brome (*Bromus vulgaris*), oniongrass (*Melica bulbosa*), northwestern sedge (*Carex concinnoides*) and western fescue (*Festuca occidentalis*) are found mostly in mesic forests with shrubs or mixed with forb species. Bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), and junegrass (*Koeleria macrantha*) are found in drier more open forests or woodlands.

Other Classifications and Key References. This habitat includes the moist portions of the *Pseudotsuga menziesii*, *Abies grandis*, and *Tsuga heterophylla* zones of eastern Washington. Other references describe elements of this habitat.
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Natural Disturbance Regime. Fires were probably of moderate frequency (30-100 years) in presettlement times. Inland Pacific Northwest Douglas-fir and western larch forests have a mean fire interval of 52 years. Typically, stand replacement fire-return intervals are 150-500 years with moderate severity-fire intervals of 50-100 years. Specific fire influences vary with site characteristics. Generally, wetter sites burn less frequently and stands are older with more western hemlock and western redcedar than drier sites. Many sites dominated by

Douglas-fir and ponderosa pine, which were formerly maintained by wildfire, may now be dominated by grand fir (a fire sensitive, shade-tolerant species).

Succession and Stand Dynamics. Successional relationships of this type reflect complex interrelationships between site potential, plant species characteristics, and disturbance regime. Generally, early seral forests of shade-intolerant trees (western larch, western white pine, ponderosa pine, Douglas-fir) or tolerant trees (grand fir, western redcedar, western hemlock) develop some 50 years following disturbance. This stage is preceded by forb- or shrub- dominated communities. These early stage mosaics are maintained on ridges and drier topographic positions by frequent fires. Early seral forest develops into mid-seral habitat of large trees during the next 50-100 years. Stand replacing fires recycle this stage back to early seral stages over most of the landscape. Without high-severity fires, a late-seral condition develops either single-layer or multi-layer structure during the next 100-200 years. These structures are typical of cool bottomlands that usually only experience low-intensity fires.

Effects of Management and Anthropogenic Impacts. This habitat has been most affected by timber harvesting and fire suppression. Timber harvesting has focused on large shade-intolerant species in mid- and late-seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees. Mid-seral forest structure is currently 70 percent more abundant than in historical, native systems. Late-seral forests of shade-intolerant species are now essentially absent. Early-seral forest abundance is similar to that found historically but lacks snags and other legacy features.

Status and Trends. Interior Douglas-fir, Grand fir, and Western redcedar/Western hemlock cover types are more abundant now than before 1900, whereas the Western larch and Western white pine types are significantly less abundant. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western redcedar, western hemlock, and western white pine associations listed in the National Vegetation Classification are considered imperiled or critically imperiled. Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species.

Lodgepole Pine Forest and Woodlands

Rex C. Crawford

Geographic Distribution. This habitat is found along the eastside of the Cascade Range, in the Blue Mountains and the Okanogan Highlands. With grassy undergrowth, this habitat appears primarily along the eastern slope of the Cascade Range and occasionally in the Blue Mountains and Okanogan Highlands. Subalpine lodgepole pine habitat occurs on the broad plateau areas along the crest of the Cascade Range and the Blue Mountains, and in the higher elevations in the Okanogan Highlands. On pumice soils this habitat is confined to the eastern slope of the Cascade Range from near Mt. Jefferson south to the vicinity of Crater Lake.

Physical Setting. This habitat is located mostly at mid- to higher elevations (3,000-9,000 ft. These environments can be cold and relatively dry, usually with persistent winter snowpack. A few of these forests occur in low-lying frost pockets, wet areas, or under edaphic control (usually pumice) and are relatively long-lasting features of the landscape.

Landscape Setting. This habitat appears within Montane Mixed Conifer Forest east of the Cascade crest and the cooler Eastside Mixed Conifer Forest habitats. Most pumice soil lodgepole pine habitat is intermixed with Ponderosa Pine Forest and Woodland habitats and is located between Eastside Mixed Conifer Forest habitat and either Western Juniper Woodland or Shrub-steppe habitat.

Structure. The lodgepole pine habitat is composed of open to closed evergreen conifer tree canopies. Vertical structure is typically a single tree layer. Reproduction of other more shade-tolerant conifers can be abundant in the undergrowth. Several distinct undergrowth types develop under the tree layer: evergreen or deciduous medium-tall shrubs, evergreen low shrub, or graminoids with few shrubs. On pumice soils, a sparsely developed shrub and graminoid undergrowth appears with open to closed tree canopies.

Composition. The tree layer of this habitat is dominated by lodgepole pine (*Pinus contorta* var. *latifolia* and *P. c.* var. *murrayana*), but it is usually associated with other montane conifers (*Abies concolor, A. grandis, A. magnifici var. shastensi, Larix occidentalis, Calocedrus decurrens, Pinus lambertiana, P. monticola, P. ponderosa, Pseudotsuga menziesii*). Subalpine fir (*Abies lasiocarpa*), mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and whitebark

pine (*Pinus albicaulis*), indicators of subalpine environments, are present in colder or higher sites. Quaking aspen (*Populus tremuloides)* sometimes occur in small numbers. Shrubs can dominate the undergrowth. Tall deciduous shrubs include Rocky Mountain maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), or Scouler's willow (*Salix scouleriana*). These tall shrubs often occur over a layer of mid-height deciduous shrubs such as baldhip rose *(Rosa gymnocarpa),* russet buffaloberry *(Shepherdia canadensis*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus* and/or *S. mollis*). At higher elevations, big huckleberry (*Vaccinium membranaceum*) can be locally important, particularly following fire. Mid-tall evergreen shrubs can be abundant in some stands, for example, creeping Oregon grape (*Mahonia repens*), tobacco brush (*Ceanothus velutinus*), and Oregon boxwood (*Paxistima myrsinites*). Colder and drier sites support low-growing evergreen shrubs, such as kinnikinnick (*Arctostaphylos uva-ursi*) or pinemat manzanita (*A. nevadensis*). Grouseberry (*V. scoparium*) and beargrass (*Xerophyllum tenax*) are consistent evergreen low shrub dominants in the subalpine part of this habitat. Manzanita (*Arctostaphylos patula),* kinnikinnick, tobacco brush*,* antelope bitterbrush (*Purshia tridentata*), and wax current (*Ribes cereum*) are part of this habitat on pumice soil. Some undergrowth is dominated by graminoids with few shrubs. Pinegrass (*Calamagrostis rubescens*) and/or Geyer's sedge (*Carex geyeri*) can appear with grouseberry in the subalpine zone. Pumice soils support grassy undergrowth of long-stolon sedge (*C. inops*), Idaho fescue (*Festuca idahoensis*) or western needlegrass (*Stipa occidentalis*). The latter 2 species may occur with bitterbrush or big sagebrush and other bunchgrass steppe species. Other non-dominant indicator graminoids frequently encountered in this habitat are California oatgrass (*Danthonia californica*), blue wildrye (*Elymus glaucus*), Columbia brome (*Bromus vulgaris*) and oniongrass (*Melica bulbosa*). Kentucky bluegrass (*Poa pratensis*), and bottlebrush squirreltail (*Elymus elymoides*) can be locally abundant where livestock grazing has persisted. The forb component of this habitat is diverse and varies with environmental conditions. A partial forb list includes goldthread (*Coptis occidentalis*), false solomonseal (*Maianthemum stellata*), heartleaf arnica *(Arnica cordifolia),* several lupines (*Lupinus caudatus, L. latifolius, L. argenteus* ssp. *argenteus* var*. laxiflorus),* meadowrue (*Thalictrum occidentale*), queen's cup (*Clintonia uniflora*), rattlesnake plantain (*Goodyera oblongifolia*), skunkleaf polemonium (*Polemonium pulcherrimum*), trailplant (*Adenocaulon bicolor*), twinflower (*Linnaea borealis*), Sitka valerian (*Valeriana sitchensis*), western starflower (*Trientalis latifolia*), and several wintergreens (*Pyrola asarifolia, P. picta, Orthilia secunda*).

Other Classifications and Key References. The Lodgepole Pine Forest and Woodland habitat includes the *Pinus contorta* zone of eastern Washington. Quigley and Arbelbide referred to this habitat as Lodgepole pine cover type and as a part of the Dry Forest potential vegetation group. Other references detail forest associations with this habitat.

Natural Disturbance Regime. This habitat typically reflects early successional forest vegetation that originated with fires. Inland Pacific Northwest lodgepole pine has a mean fire interval of 112 years. Summer drought areas generally have low to medium-intensity ground fires occurring at intervals of 25-50 years, whereas areas with more moisture have a sparse undergrowth and slow fuel build-up that results in less frequent, more intense fire. With time, lodgepole pine stands increase in fuel loads. Woody fuels accumulate on the forest floor from insect (mountain pine beetle) and disease outbreaks and residual wood from past fires. Mountain pine beetle outbreaks thin stands that add fuel and create a drier environment for fire or open canopies and create gaps for other conifer regeneration. High severity crown fires are likely in young stands, when the tree crowns are near deadwood on the ground. After the stand opens up, shade-tolerant trees increase in number.

Succession and Stand Dynamics. Most Lodgepole Pine Forest and Woodlands are early- to mid seral stages initiated by fire. Typically, lodgepole pine establishes within 10-20 years after fire. This can be a gap phase process where seed sources are scarce. Lodgepole stands break up after 100-200 years. Without fires and insects, stands become more closed-canopy forest with sparse undergrowth. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers. Lodgepole pine on pumice soils is not seral to other tree species; these extensive stands, if not burned, thin naturally, with lodgepole pine regenerating in patches. On poorly drained pumice soils, quaking aspen sometimes plays a mid-seral role and is displaced by lodgepole when aspen clones die. Serotinous cones (cones releasing seeds after fire) are uncommon in eastern Oregon lodgepole pine (*P. c*. var. *murrayana*). On the Colville National Forest in Washington, only 10% of lodgepole pine (*P. c*. var. *latifolia*) trees in low-elevation Douglas-fir habitats had serotinous cones, whereas 82% of cones in high-elevation subalpine fir habitats were serotinous.

Effects of Management and Anthropogenic Impacts. Fire suppression has left many single canopy lodgepole pine habitats unburned to develop into more multilayered stands. Thinning of serotinous lodgepole pine forests with fire intervals <20 years can reduce their importance over time. In pumice-soil lodgepole stands, lack of natural.

Status and Trends. Quigley and Arbelbide concluded that the extent of the lodgepole pine cover type in Oregon and Washington is the same as before 1900 and in regions may exceed its historical extent. Five percent of Pacific Northwest lodgepole pine associations listed in the National Vegetation Classification are considered imperiled. At a finer scale, these forests have been fragmented by roads, timber harvest, and influenced by periodic livestock grazing and altered fire regimes.

Ponderosa Pine Forest and Woodlands (includes Eastside Oak)

Rex C. Crawford and Jimmy Kagan

Geographic Distribution. This habitat occurs in much of eastern Washington, including the eastern slopes of the Cascades, the Blue Mountains and foothills, and the Okanogan Highlands. Ponderosa pine woodland and savanna habitats occur in the foothills of the Blue Mountains, along the eastern base of the Cascade Range, the Okanogan Highlands, and in the Columbia Basin in northeastern Washington.

Physical Setting. This habitat generally occurs on the driest sites supporting conifers in the Pacific Northwest. It is widespread and variable, appearing on moderate to steep slopes in canyons, foothills, and on plateaus or plains near mountains. Average annual precipitation ranges from about 14 to 30 inches on ponderosa pine sites and often occurs as snow. This habitat can be found at elevations of 100 ft in the Columbia River Gorge to dry, warm areas over 6,000 ft . Timber harvest, livestock grazing, and pockets of urban development are major land uses.

Landscape Setting. This woodland habitat typifies the lower treeline zone forming transitions with Eastside Mixed Conifer Forest and Western Juniper and Mountain Mahogany Woodland, Shrub-steppe, Eastside Grassland, or Agriculture habitats. Douglas-fir-ponderosa pine woodlands are found near or within the Eastside Mixed Conifer Forest habitat. Oregon oak woodlands appear in the driest most restricted landscapes in transition to Eastside Grassland or Shrub-steppe.

Structure. This habitat is typically a woodland or savanna with tree canopy coverage of 10-60 percent, although closed-canopy stands are possible. The tree layer is usually composed of widely spaced large conifer trees. Many stands tend towards a multi-layered condition with encroaching conifer regeneration. Isolated taller conifers above broadleaf deciduous trees characterize part of this habitat. Deciduous woodlands or forests are an important part of the structural variety of this habitat. Clonal deciduous trees can create dense patches across a grassy landscape rather than scattered individual trees. The undergrowth may include dense stands of shrubs or, more often, be dominated by grasses, sedges, or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree-shrub-sparse-grassland habitat.

Composition. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are the most common evergreen trees in this habitat. Grand fir (Abies grandis) may be frequent in the undergrowth on more productive sites giving stands a multi-layer structure. In rare instances, grand fir can be co-dominant in the upper canopy. Tall ponderosa pine

over Oregon white oak (*Quercus garryana*) trees form stands along part of the eastern Cascades. These stands usually have younger cohorts of pines. Oregon white oak dominates open woodlands or savannas in limited areas. The undergrowth can include dense stands of shrubs or, more often, be dominated by grasses, sedges, and/or forbs. Some Douglas-fir and ponderosa pine stands have a tall to medium-tall deciduous shrub layer of mallowleaf ninebark (*Physocarpus malvaceus*) or common snowberry (*Symphoricarpos albus*). Grand fir seedlings or saplings may be present in the undergrowth. Short shrubs such as kinnikinnick (*A. uva-ursi*) are found across the range of this habitat. Antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), black sagebrush (*A. nova*) and green rabbitbrush (Chrysothamnus viscidiflorus) often grow with Douglas-fir, ponderosa pine and/or Oregon white oak, which typically have a bunchgrass and shrub-steppe ground cover. Undergrowth is generally dominated by herbaceous species, especially graminoids. Within a forest matrix, these woodland habitats have an open to closed sodgrass undergrowth. Drier savanna and woodland undergrowth typically contains bunchgrass steppe species, such as Idaho fescue (*Festuca idahoensis*), rough fescue (*F. campestris*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Oryzopsis hymenoides*), or needlegrasses (*Stipa comata, S. occidentalis*). Forbs are common associates in this habitat and are too numerous to be listed.

Other Classifications and Key References. This habitat is referred to as Pacific ponderosa pine-Douglas-fir and Pacific ponderosa pine, and Oregon white oak by the Society of American Foresters. Other references describe elements of this habitat.

Natural Disturbance Regime. Fire plays an important role in creating vegetation structure and composition in this habitat. Most of the habitat has experienced frequent low-severity fires that maintained woodland or savanna conditions. A mean fire interval of 20 years for ponderosa pine is the shortest of the vegetation types. Soil drought plays a role in maintaining an open tree canopy in part of this dry woodland habitat.

Succession and Stand Dynamics. This habitat is climax on sites near the dry limits of each of the dominant conifer species and is more seral as the environment becomes more favorable for tree growth. Open seral stands are gradually replaced by more closed shade-tolerant climax stands. Oregon white oak can reproduce under its own shade but is intolerant of overtopping by conifers. Oregon white oak woodlands are considered fire climax and are seral to conifers. In drier conditions, unfavorable to conifers, oak is climax. Oregon white oak sprouts from the trunk and root crown following cutting or burning and form clonal patches of trees.

Effects of Management and Anthropogenic Impacts. Pre-1900, this habitat was mostly open and park like with relatively few undergrowth trees. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multi-layered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the canopy dominant. Fire suppression has lead to a buildup of fuels that in turn increase the likelihood of stand-replacing fires. Heavy grazing, in contrast to fire, removes the grass cover and tends to favor shrub and conifer species. Fire suppression combined with grazing creates conditions that support cloning of oak and invasion by conifers. Large late seral ponderosa pine, Douglas-fir, and Oregon white oak are harvested in much of this habitat. Under most management regimes, typical tree size decreases and tree density increases in this habitat. Ponderosa pine-Oregon white oak habitat is now denser than in the past and may contain more shrubs than in pre-settlement habitats. In some areas, new woodlands have been created by patchy tree establishment at the forest-steppe boundary.

Status and Trends. Interior Ponderosa Pine cover type is significantly less in extent than pre-1900 and that the Oregon White Oak cover type is greater in extent than pre-1900. The greatest structural change in this habitat is the reduced extent of the late-seral, single-layer condition. This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses. One third of Pacific Northwest Oregon white oak, ponderosa pine, and dry Douglas-fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Upland Aspen Forest

Rex C. Crawford and Jimmy Kagan

Geographic Distribution. Quaking aspen groves are the most widespread habitat in North America, but are a minor type throughout eastern Washington. Upland Aspen habitat is found in the northeastern Cascade of Washington. Aspen stands are much more common in the Rocky Mountain states.

Physical Setting. This habitat generally occurs on well-drained mountain slopes or canyon walls that have some moisture. Rockfalls, talus, or stony north slopes are often typical sites. It may occur in steppe on moist microsites. This habitat is not associated with streams, ponds, or wetlands. This habitat is found from 2,000 to 9,500 ft elevation.

Landscape Setting. Aspen forms a "subalpine belt" above the Western Juniper and Mountain Mahogany Woodland habitat and below Montane Shrubsteppe Habitat on Steens Mountain in southern Oregon. It can occur in seral stands in the lower Eastside Mixed Conifer Forest and Ponderosa Pine Forest and Woodlands habitats. Primary land use is livestock grazing.

Structure. Deciduous trees usually less than 48 feet tall dominate this woodland or forest habitat. The tree layer grows over a forb-, grass-, or low shrub-dominated undergrowth. Relatively simple 2-tiered stands characterize the typical vertical structure of woody plants in this habitat. This habitat is composed of one to many clones of trees with larger trees toward the center of each clone. Conifers invade and create mixed evergreen-deciduous woodland or forest habitats.

Composition. Quaking aspen (*Populus tremuloides*) is the characteristic and dominant tree in this habitat. It is the sole dominant in many stands although scattered ponderosa pine (*Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) may be present. Snowberry (*Symphoricarpos oreophilus* and less frequently, *S. albus*) is the most common dominant shrub. Tall shrubs, Scouler's willow (*Salix scouleriana*) and serviceberry (*Amelanchier alnifolia*) may be abundant. On mountain or canyon slopes, antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp.

vaseyana), low sagebrush (*A. arbuscula*), and curl-leaf mountain mahogany (*Cercocarpus ledifolius*) often occur in and adjacent to this woodland habitat. In some stands, pinegrass (*Calamagrostis rubescens*) may dominate the ground cover without shrubs. Other common grasses are Idaho fescue (*Festuca idahoensis*), California brome (*Bromus carinatus*), or blue wildrye (*Elymus glaucus*). Characteristic tall forbs include horsemint (*Agastache* spp.), aster (*Aster* spp.), senecio (*Senecio* spp.), coneflower (*Rudbeckia* spp.). Low forbs include meadowrue (*Thalictrum* spp.), bedstraw (*Galium* spp.), sweet cicely (*Osmorhiza* spp.), and valerian (*Valeriana* spp.).

Other Classifications and Key References. This habitat is called "Aspen" by the Society of American Foresters and "Aspen woodland" by the Society of Range Management.

Natural Disturbance Regime. Fire plays an important role in maintenance of this habitat. Quaking aspen will colonize sites after fire or other stand disturbances through root sprouting. Research on fire scars in aspen stands in central Utah indicated that most fires occurred before 1885, and concluded that the natural fire return interval was 7-10 years. Ungulate browsing plays a variable role in aspen habitat; ungulates may slow tree regeneration by consuming aspen sprouts on some sites, and may have little influence in other stands.

Succession and Stand Dynamics. There is no generalized successional pattern across the range of this habitat. Aspen sprouts after fire and spreads vegetatively into large clonal or multi-clonal stands. Because aspen is shade intolerant and cannot reproduce under its own canopy, conifers can invade most aspen habitat. In central Utah, quaking aspen was invaded by conifers in 75-140 years. Apparently, some aspen habitat is not invaded by conifers, but eventually clones deteriorate and succeed to shrubs, grasses, and/or forbs. This transition to grasses and forbs occurs more likely on dry sites.

Effects of Management and Anthropogenic Impacts. Domestic sheep reportedly consume four times more aspen sprouts than do cattle. Heavy livestock browsing can adversely impact aspen growth and regeneration. With fire suppression and alteration of fine fuels, fire rejuvenation of aspen habitat has been greatly reduced since about 1900. Conifers now dominate many seral aspen stands and extensive stands of young aspen are uncommon.

Status and Trends. With fire suppression and change in fire regimes, the Aspen Forest habitat is less common than before 1900. None of the five Pacific Northwest upland quaking aspen community types in the National Vegetation Classification is considered imperiled.

Subalpine Parkland

Rex C. Crawford and Christopher B. Chappell

Geographic Distribution. The Subalpine Parkland habitat occurs throughout the high mountain ranges of Washington (e.g., Cascade crest, Olympic Mountains, and Okanogan Highlands).

Physical Setting. Climate is characterized by cool summers and cold winters with deep snowpack, although much variation exists among specific vegetation types. Mountain hemlock sites receive an average precipitation of >50 inches in 6 months and several feet of snow typically accumulate. Whitebark pine sites receive 24-70 inches per year and some sites only rarely accumulate a significant snowpack. Summer soil drought is possible in eastside parklands but rare in west side areas. Elevation varies from 4,500 to 6,000 ft in the western Cascades and Olympic Mountains and from 5,000 to 8,000 ft in the eastern Cascades.

Landscape Setting. The Subalpine Parkland habitat lies above the Mixed Montane Conifer Forest or Lodgepole Pine Forest habitat and below the Alpine Grassland and Shrubland habitat. Associated wetlands in subalpine parklands extend up a short distance into the alpine zone. Primary land use is recreation, watershed protection, and grazing.

Structure. Subalpine Parkland habitat has a tree layer typically between 10 and 30 percent canopy cover. Openings among trees are highly variable. The habitat appears either as parkland, that is, a mosaic of treeless openings and small patches of trees often with closed canopies, or as woodlands or savanna-like stands of scattered trees. The ground layer can be composed of (1) low to matted dwarf shrubs (<1 ft tall) that are evergreen or deciduous and often small-leaved; (2) sod grasses, bunchgrasses, or sedges; (3) forbs; or (4) moss- or lichen-covered soils. Herb or shrub-dominated wetlands appear within the parkland areas and are considered part of this habitat; wetlands can occur as deciduous shrub thickets up to 6.6 ft tall, as scattered tall shrubs, as dwarf shrub thickets, or as short herbaceous plants <1.6 ft tall. In general, western Cascades and Olympic areas are mostly parklands composed of a mosaic of patches of trees interspersed with heather shrublands or

wetlands, whereas eastern Cascades and Rocky Mountain areas are parklands and woodlands typically dominated by grasses or sedges, with fewer heathers.

Composition. Species composition in this habitat varies with geography or local site conditions. The tree layer can be composed of one or several tree species. Subalpine fir (*Abies lasiocarpa*), Engelmann spruce (Picea engelmannii) and lodgepole pine (Pinus contorta) are found throughout the Pacific Northwest. Alaska yellowcedar (*Chamaecyparis nootkatensis*), Pacific silver fir (*A. amabilis*), and mountain hemlock (*Tsuga mertensiana*) are most common in the Olympics and Cascades. Whitebark pine (*P. albicaulis*) is found primarily in the eastern Cascade Mountains, Okanogan Highlands, and Blue Mountains. Subalpine larch (*Larix lyallii*) occurs only in the northern Cascade Mountains, primarily east of the crest. West Cascades and Olympic areas generally are parklands. Tree islands often have big huckleberry (*Vaccinium membranaceum*) in the undergrowth interspersed with heather shrublands between. Openings are composed of pink mountain-heather (*Phyllodoce empetriformis*), white mountainheather (*Cassiope mertensiana*) and Cascade blueberry (*Vaccinium deliciosum*). Drier areas are more woodland or savanna-like, often with low shrubs, such as common juniper, kinnikinnick (*Arctostaphylos uva-ursi*), low whortleberries or grouseberries (*Vaccinium myrtillus* or *V. scoparium*) or beargrass (*Xerophyllum tenax*) dominating the undergrowth. Wetland shrubs in the Subalpine Parkland habitat include bog-laurel (*Kalmia microphylla*), Booth's willow (*Salix boothii*), undergreen willow (*S. commutata*), and blueberries (*Vaccinium uliginosum or V. deliciosum*). Tufted hairgrass (*Deschampsia caespitosa*) is characteristic of subalpine wetlands. The remaining flora of this habitat is diverse and complex. The following herbaceous broadleaf plants are important indicators of differences in the habitat: American bistort (*Polygonum bistortoides*), American false hellebore (*Veratrum viride*), fringe leaf cinquefoil (*Potentilla flabellifolia*), marsh marigolds (*Caltha leptosepala*), avalanche lily (*Erythronium montanum*), partridgefoot (*Luetkea pectinata*), Sitka valerian (*Valeriana sitchensis*), subalpine lupine (*Lupinus arcticus* ssp. *subalpinus*), and alpine aster (*Aster alpigenus*). Showy sedge (*Carex spectabilis*) is also locally abundant.

Other Classifications and Key References. This habitat is called the Hudsonian Zone, Parkland subzone, meadow-forest mosaic 74, upper subalpine zone, Meadows and Park, and Subalpine Parkland in various references. Other references describe elements of this habitat.

Natural Disturbance Regime. Although fire is rare to infrequent in this habitat, it plays an important role, particularly in drier environments. Whitebark pine woodland fire intervals varied from 50 to 300 years before 1900. Mountain hemlock parkland fire reoccurrence is 400-800 years. Wind blasting by ice and snow crystals is a critical factor in these woodlands and establishes the higher limits of the habitat. Periodic shifts in climatic factors, such as drought, snowpack depth, or snow duration either allow tree invasions into meadows and shrublands or eliminate or retard tree growth. Volcanic activity plays a long-term role in establishing this habitat. Wetlands are usually seasonally or perennially flooded by snowmelt and springs, or by sub-irrigation.

Succession and Stand Dynamics. Succession in this habitat occurs through a complex set of relationships between vegetation response to climatic shifts and catastrophic disturbance, and plant species interactions and site modification that create microsites. A typical succession of subalpine trees into meadows or shrublands begins with the invasion of a single tree, subalpine fir and mountain hemlock in the wetter climates and whitebark pine and subalpine larch in drier climates. If the environment allows, tree density slowly increases (over decades to centuries) through seedlings or branch layering by subalpine fir. The tree patches or individual trees change the local environment and create microsites for

shade-tolerant trees, Pacific silver fir in wetter areas, and subalpine fir and Engelmann spruce in drier areas. Whitebark pine, an early invading tree, is dispersed long distances by Clark's nutcrackers and shorter distances by mammals. Most other tree species are wind dispersed.

Effects of Management and Anthropogenic Impacts. Fire suppression has contributed to change in habitat structure and functions. For example, the current "average" whitebark pine stand will burn every 3,000 years or longer because of fire suppression. Blister rust, an introduced pathogen, is increasing whitebark pine mortality in these woodlands. Even limited logging can have prolonged effects because of slow invasion rates of trees. This is particularly important on drier sites and in subalpine larch stands. During wet cycles, fire suppression can lead to tree islands coalescing and the conversion of parklands into a more closed forest habitat. Parkland conditions can displace alpine conditions through tree invasions. Livestock use and heavy horse or foot traffic can lead to trampling and soil compaction. Slow growth in this habitat prevents rapid recovery.

Status and Trends. This habitat is generally stable with local changes to particular tree variants. Whitebark pine maybe declining because of the effects of blister rust or fire suppression that leads to conversion of parklands to more closed forest. Global climate warming will likely have an amplified effect throughout this habitat. Less than 10 percent of Pacific Northwest subalpine parkland community types listed in the National Vegetation Classification are considered imperiled.

Westside Grasslands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is restricted primarily to the Puget Lowland ecoregion, with most now occurring in Pierce, Thurston and San Juan counties, Washington. It also occurs in scattered small outliers in the eastern Olympic Mountains and the western Cascades.

Physical Setting. The climate is mild and moderately dry (17-55 inches mean annual precipitation), with moist winters and dry summers. Elevation is mostly low and ranges up to a maximum of about 3,500 feet. Topography varies from flat to mounded or rolling to steep slopes. Most sites are topoedaphically dry and experience extreme soil drought in the summer. Much of what currently remains of this habitat is found on the South Puget prairies, which are underlain by very deep gravelly/sandy glacial outwash that is excessively well drained. Many other small sites, often called “balds”, have shallow soils overlying bedrock and typically are on south- or west-facing slopes.

Landscape Setting. This habitat occurs adjacent to or in a mosaic with Westside Riparian-Wetlands, Westside Oak and Dry Douglas-fir Forests and Woodlands, Agriculture or Urban habitats. Westside grassland habitat occurs less commonly in a matrix of Westside Lowland Conifer-Hardwood Forest. In the San Juan Islands, the habitat sometimes occurs on bluffs or slopes adjacent to marine habitats. Currently this habitat is used for grazing, recreation, and, in the southern Puget Sound area, for military training.

Structure. This habitat is grassland or, less commonly, savanna, with <30% tree or shrub cover. Bunchgrasses predominate in native-dominated sites, with space between the vascular plants typically covered by mosses, fruticose lichens, or native forbs. Montane balds are sometimes dominated in part by short forbs (<1.6 ft) or dwarf shrubs. Degraded sites are dominated by rhizomatous exotic grasses with some native herbaceous component still present. Scattered trees are either evergreen conifers or deciduous broadleaves. Shrubs may be absent, scattered, or very prominent, and include evergreen and deciduous broadleaf physiognomy.

Composition. The major native dominant bunchgrass is Roemer’s fescue (*Festuca idahoensis* var. *roemeri*). Red fescue (*F. rubra*) and California oatgrass (*Danthonia*

californica) are frequently dominant or co-dominant on a local basis. Long-stolon sedge (*Carex inops*) is occasionally co-dominant, especially in savannas and in the Columbia Gorge. Slender wheatgrass (*Elymus trachycaulus*), blue wildrye (*E. glaucus*), prairie junegrass (*Koeleria macrantha*), and Lemmon's needlegrass (*Stipa lemmonii*) can be important locally. Major exotic dominant species are colonial bentgrass (*Agrostis capillaris*), sweet vernalgrass (*Anthoxanthum odoratum*), Kentucky bluegrass (*Poa pratensis*), tall oatgrass (*Arrhenatherum elatius*), medusahead (*Taeniatherum caput-medusae*), tall fescue (*F. arundinacea*), and soft brome (*Bromus mollis*). Common camas (*Camassia quamash*) is probably the most important forb in terms of cover, but it rarely dominates. The bracken fern (*Pteridium aquilinum*) is sometimes co-dominant. A rich diversity of native forbs is typical of sites in good condition. Roemer's fescue is distributed throughout the Puget Lowland and in montane balds of the eastern and northeastern Olympics. Native red fescue is a major component near saltwater in the northern Puget Lowland and in montane balds of the Columbia Gorge. Non-native varieties of red fescue can occur throughout the area, especially in degraded habitats. California oatgrass communities are found in the San Juan Islands. Junegrass is a co-dependent in some montane balds; it occurs less abundantly throughout the area. Lemmon's needlegrass is primarily found on shallow-soiled balds of the San Juan Islands. The most common savanna tree is Douglas-fir (*Pseudotsuga menziesii*). Oregon white oak (*Quercus garryana*) formerly was part of extensive savannas, but is now rare in that structural condition. Ponderosa pine (*Pinus ponderosa*) is very local. The most common shrub is the exotic species Scot's broom (*Cytisus scoparius*), which frequently forms open stands over the grass. Common snowberry (Symphoricarpos albus), Nootka rose (*Rosa nutkana*), poison-oak (Toxicodendron diversilobum), and serviceberry (*Amelanchier alnifolia*) are other common shrubs. The dwarf shrubs kinnikinnick (*Arctostaphylos uva-ursi*) and common juniper (*Juniperus communis*) sometimes dominate small areas in montane balds, and the former sometimes on South Puget prairies. *Racomitrium canescens* is the most common ground moss.

Other Classifications and Key References. Portions of this habitat have been referred to as prairies by many authors. Franklin and Dyrness described this habitat as prairie in the Puget Sound area and grassland in the San Juan Islands. The Washington Gap project mapped this habitat as part of nonforested in the Woodland/Prairie Mosaic Zone. Other references describe elements of this habitat.

Natural Disturbance Regime. Historically, fire was a major component of this habitat. In addition to occasional lightning strikes, fires were intentionally set by indigenous inhabitants to maintain food staples such as camas and bracken fern. Although there is no definitive fire history information, evidence suggests that many, if not most, of these grasslands burned every few years. Annual soil drought naturally eliminated or thinned invading trees and promoted higher frequency fire regimes in the past.

Succession and Stand Dynamics. Historically, regular fires or extreme environmental conditions on the most xeric sites prevented the establishment and continued growth of most woody vegetation, thereby maintaining the grasslands and oak savannas. In some patches, scattered oaks or even Douglas-fir survived long enough to obtain some fire resistance and the frequent light fires then helped to maintain savannas. Oaks were also able to resprout if the above-ground stem was killed. High fire frequencies combined with digging of roots by Native Americans could have favored the abundance of forbs over that of grasses in many areas of the pre-European landscape.

Effects of Management and Anthropogenic Impacts. The exclusion of fire from most of this habitat over the last 100+ years has resulted in profound changes. Oak savanna has, for all practical purposes, disappeared from the landscape. Douglas-fir encroachment, in the absence of fire, is a "natural" process that occurs eventually on the vast majority of westside grasslands, except perhaps on the very driest sites. This encroachment leads to the conversion of grasslands to forests. Fire exclusion has also resulted in increases in shrub cover and the conversion of some grasslands to shrublands. Exotic species are prominent in this habitat and generally increase after ground-disturbing activities like grazing or off-road vehicle use. Scot's broom, tall oatgrass, colonial bentgrass, sweet vernalgrass, tall fescue, common velvetgrass (*Holcus lanatus*), Kentucky bluegrass, soft brome, common St. Johnswort (*Hypericum perforatum*), and hairy cat's ear (*Hypochaeris radicata*) are among the most troublesome species. The dominant native grass, Roemer's fescue, can be eliminated with heavy grazing. Prescribed fire and other management tolls have been used recently to control Scot's broom, Douglas-fir encroachment, and to attempt to mimic historical conditions in some areas.

Status and Trends. This habitat is very rare and limited in areal extent. In the southern Puget Sound area, only about 10% of the original area of the habitat is extant, and only 3% is dominated by native species. Overall decline is significantly greater than these figures suggest because the habitat is even more decimated and degraded elsewhere. Causes of the decline are fire suppression, conversion to agriculture and urban, and invasion of exotic species. Most of what remains is dominated or co-dominated by exotic species. Current trends are continued decline both in area and condition. Ongoing threats include urban conversion, increase of exotic species, ground disturbance via tracked vehicle use for military training, and effects of fire suppression. Eleven out of 12 native plant association representing this habitat listed for the National Vegetation Classification are considered imperiled or critically imperiled.

Eastside (Interior) Grasslands

Rex. C. Crawford and Jimmy Kagan

Geographic Distribution. This habitat is found primarily in Washington at mid- to low elevations and on plateaus in the Blue Mountains. Idaho fescue grassland habitats were formerly widespread in the Palouse region of southeastern Washington; most of this habitat has been converted to agriculture. Idaho fescue grasslands still occur in isolated, moist sites near lower treeline in the foothills of the Blue Mountains, the Northern Rockies, and east Cascades near the Columbia River Gorge. Bluebunch wheatgrass grassland habitats are common throughout the Columbia Basin, both as modified native grasslands in deep canyons and the dry Palouse and as fire-induced representatives in the shrub-steppe. Sand dropseed and three-awn needlegrass grassland habitats are restricted to river terraces in the Columbia Basin and Blue Mountains of Washington.

Physical Setting. This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8-20 inches; only 10 percent falls in the hottest months, July through September. Snow accumulation is low (1-6 inches) and occurs only in January and February in eastern portions of its range and November through March in the west. More snow accumulates in grasslands within the forest matrix. Soils are variable: (1) highly productive loess soils up to 51 inches deep, (2) rocky flats, (3) steep slopes, and (4) sandy, gravel or cobble soils. An important variant of this habitat occurs on sandy, gravelly, or silty river terraces or seasonally exposed river gravel or Spokane flood deposits. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500 to 6,000 ft in elevation.

Landscape Setting. Eastside grassland habitat appears well below and in a matrix with lower treeline Ponderosa Pine Forests and Woodlands. It can also be part of the lower elevation forest matrix. Most grassland habitat occurs in 2 distinct large landscapes: plateau and canyon grasslands. Several rivers flow through narrow basalt canyons below plateaus supporting prairies or shrub-steppe. The canyons can be some 2,132 ft deep below the plateau. The plateau above is composed of gentle slopes with deep silty loess soils in an expansive rolling dune-like landscape. Grasslands may occur in a patchwork with shallow soil scablands or within biscuit scablands or mounded topography. Naturally occurring grasslands are beyond the range of bitterbrush and sagebrush species. This habitat exists today in the shrub-steppe landscape where grasslands are created by brush removal, chaining or spraying, or by fire. Agricultural uses and introduced perennial plants on abandoned or planted fields are common throughout the

current distribution of eastside grassland habitats.

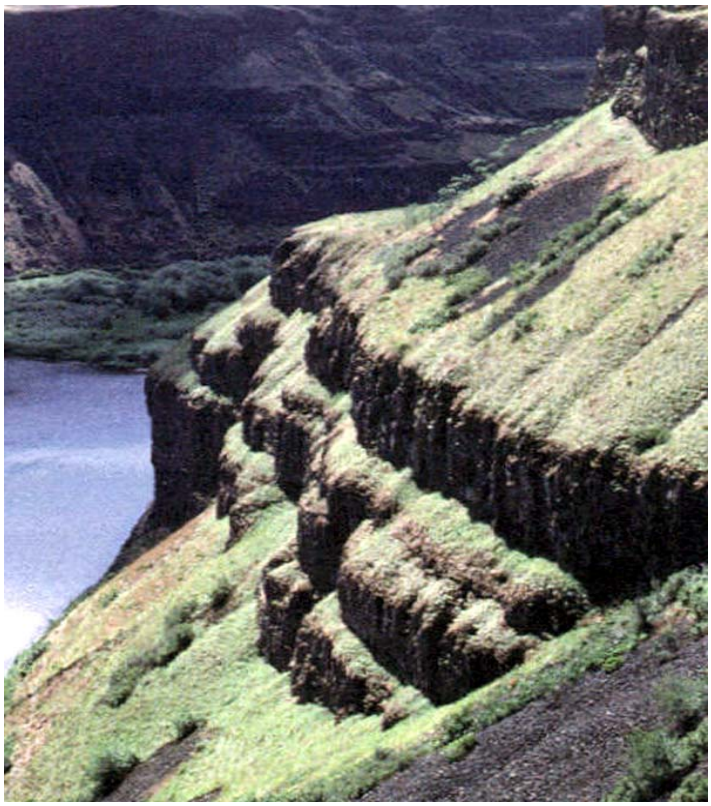
Structure. This habitat is dominated by short to medium-tall grasses (<3.3 ft). Total herbaceous cover can be closed to only sparsely vegetated. In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall grasslands often have scattered and diverse patches of low shrubs, but few or no medium-tall shrubs (<10 percent cover of shrubs are taller than the grass layer). Native forbs may contribute significant cover or they may be absent. Grasslands in canyons are dominated by bunchgrasses growing in lower densities than on deep-soil prairie sites. The soil surface between perennial plants can be covered with a diverse cryptogamic or microbiotic layer of mosses, lichens, and various soil bacteria and algae. Moister environments can support a dense sod of rhizomatous perennial grasses. Annual plants are a common spring and early summer feature of this habitat.

Composition. Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) are the characteristic native bunchgrasses of this habitat and either or both can be dominant. Idaho fescue is common in more moist areas and bluebunch wheatgrass more abundant in drier areas. Rough fescue (*F. campestris*) is a characteristic dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn (*Aristida longiseta*) are native dominant grasses on hot, dry sites in deep canyons. Sandberg bluegrass (*Poa sandbergii*) is usually present, and occasionally codominant in drier areas. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Annual grasses are usually present; cheatgrass (Bromus tectorum) is the most widespread. In addition, medusahead (*Taeniatherum caput-medusae*), and other annual bromes (*Bromus commutatus, B. mollis, B. japonicus*) may be present to co-dominant. Moist environments, including riparian bottomlands, are often co-dominated by Kentucky bluegrass (*Poa pratensis*). A dense and diverse forb layer can be present or entirely absent; >40 species of native forbs can grow in this habitat including balsamroots (*Balsamorhiza* spp.), biscuitroots (*Lomatium* spp.), buckwheat (*Eriogonum* spp.), fleabane (*Erigeron* spp.), lupines (*Lupinus* spp.), and milkvetches (*Astragalus* spp.). Common exotic forbs that can grow in this habitat are knapweeds (*Centaurea solstitialis, C. diffusa, C. maculosa*), tall tumblemustard (*Sisymbrium altissimum*), and Russian thistle (Salsola kali). Smooth sumac (*Rhus glabra*) is a deciduous shrub locally found in combination with these grassland species. Rabbitbrushes (*Chrysothamnus nauseosus, C. viscidiflorus*) can occur in this habitat in small amounts, especially where grazed by livestock. In moist Palouse regions, common snowberry (*Symphoricarpos albus*) or Nootka rose (*Rosa nutkana*) may be present, but is shorter than the bunchgrasses. Dry sites contain low succulent prickly pear (*Opuntia polyacantha*). Big sagebrush (*Artemisia tridentata*) is occasional and may be increasing in grasslands on former shrub-steppe sites. Black hawthorn (*Crataegus douglasii*) and other tall shrubs can form dense thickets near Idaho fescue grasslands. Rarely, ponderosa pine (*Pinus ponderosa*) or western juniper (*Juniperus occidentalis*) can occur as isolated trees.

Other Classifications and Key References. This habitat is called Palouse Prairie, Pacific Northwest grassland, steppe vegetation, or bunchgrass prairie in general ecological literature. Washington GAP types 13, 21, 22, 24, 29-31, 82, and 99 map this habitat. Franklin and Dyrness include this habitat in steppe zones of Washington. Other references describe elements of this habitat.

Natural Disturbance Regime. The fire-return interval for sagebrush and bunchgrass is estimated at 25 years. The native bunchgrass habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. Currently fires burn less frequently in the Palouse grasslands than historically because of fire suppression, roads, and conversions to cropland. Without fire, black hawthorn shrubland patches expand on slopes along with common snowberry and rose. Fires covering large areas of shrub-steppe habitat can eliminate shrubs and their seed sources and create eastside grassland habitat. Fires that follow heavy grazing or repeated early season fires can result in annual grasslands of cheatgrass, medusahead, knapweed, or yellow star-thistle. Annual exotic grasslands are common in dry grasslands and are included in modified grasslands as part of the Agriculture habitat.



Effects of Management and Anthropogenic Impacts. Large expanses of grasslands are currently used for livestock ranching. Deep soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands, those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands. Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent annual grass and forblands. Some annual grassland, native bunchgrass, and shrub-steppe habitats were converted to intermediate wheatgrass, or more commonly, crested wheatgrass (*Agropyron cristatum*)-dominated areas. These form persistent grasslands and are included as modified grasslands in the Agriculture habitat. With intense livestock use, some riparian bottomlands become dominated by non-native grasses. Many native dropseed grasslands have been submerged by dam reservoirs.

Status and Trends. Most of the Palouse prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Remnants still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the United States, with only one percent of the original habitat remaining; it is highly fragmented with most sites <10 acres. All these areas are subject to weed invasions and drift of aerial biocides. Since 1900, 94 percent of the Palouse grasslands have been converted to crop, hay, or pasture lands. Fescue-Bunchgrass and Wheatgrass bunchgrass cover types have significantly decreased in area since pre-1900, while exotic forbs and annual grasses have significantly increased since pre-1900. Fifty percent of the plant associations recognized as components of eastside grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Shrub-steppe

Rex. C. Crawford and Jimmy Kagan

Geographic Distribution. Shrub-steppe habitat is common across the Columbia Plateau of Washington. It extends up into the cold, dry environments of surrounding mountains. Basin big sagebrush Shrub-steppe occurs along stream channels, in valley bottoms and flats throughout eastern Washington. Wyoming sagebrush Shrub-steppe is the most widespread habitat in eastern Washington, occurring throughout the Columbia Plateau and the northern Great Basin. Mountain big sagebrush Shrub-steppe habitat occurs throughout the mountains of eastern Washington. Bitterbrush Shrub-steppe habitat appears primarily along the eastern slope of the Cascades, from north-central Washington to the Blue Mountains. Three-tip sagebrush Shrub-steppe occurs mostly along the northern and western Columbia Basin in Washington. Interior shrub dunes and sandy steppe and Shrub-steppe habitat is concentrated at low elevations near the Columbia River and in isolated pockets in the Northern Basin.

Physical Setting. Generally, this habitat is associated with dry, hot environments in the Pacific Northwest although variants are in cool, moist areas with some snow accumulation in climatically dry mountains. Elevation range is wide (300-9,000 ft with most habitat occurring between 2,000 and 6,000 ft). Habitat occurs on deep alluvial, loess, silty or sandy-silty soils, stony flats, ridges, mountain slopes, and slopes of lake beds with ash or pumice soils.

Landscape Setting. Shrub-steppe habitat defines a biogeographic region and is the major vegetation on average sites in the Columbia Plateau, usually below Ponderosa Pine Forest and Woodlands, and Western Juniper and Mountain Mahogany Woodlands habitats. It forms mosaic landscapes with these woodland habitats and Eastside Grasslands, Dwarf Shrub-steppe, and Desert Playa and Salt Scrub habitats. Mountain sagebrush Shrub-steppe occurs at high elevations occasionally within the dry Eastside Mixed Conifer Forest and Montane Mixed Conifer Forest habitats. Shrub-steppe habitat can appear in large landscape patches. Livestock grazing is the primary land use in the Shrub-steppe, although much has been converted to irrigation or dry land agriculture. Large areas occur in military training areas and wildlife refuges.

Structure. This habitat is a shrub savanna or shrubland with shrub coverage of 10-60 percent. In an undisturbed condition, shrub cover varies between 10 and 30 percent. Shrubs are generally evergreen, although deciduous shrubs are prominent in many habitats. Shrub height typically is medium tall (1.6-3.3 ft) although some sites support shrubs

approaching 9 ft tall. Vegetation structure in this habitat is characteristically an open shrub layer over a moderately open to closed bunchgrass layer. The more northern or productive sites generally have a denser grass layer and sparser shrub layer than southern or more xeric sites. In fact, the rare healthy site is better characterized as grassland with shrubs than a shrubland. The bunchgrass layer may contain a variety of forbs. Healthy habitat has very little exposed bare ground, and has mosses and lichens carpeting the area between taller plants. However, heavily grazed sites have dense shrubs making up >40 percent cover, with introduced annual grasses and little or no moss or lichen cover. Moist sites may support tall bunchgrasses (>3.3) or rhizomatous grasses. More southern Shrub-steppe may have native low shrubs dominating with bunchgrasses.

Composition. Characteristic and dominant mid-tall shrubs in the Shrub-steppe habitat include all three subspecies of big sagebrush, basin (*Artemisia tridentata* ssp. *tridentata*), Wyoming (*A. t.* ssp. *wyomingensis*) or mountain (*A. t.* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and two shorter sagebrushes, silver (*A. cana*) and three-tip (*A. tripartita*). Each of these species can be the only shrub or appear in complex seral conditions with other shrubs. Common shrub complexes are bitterbrush and Wyoming big sagebrush, bitterbrush and three-tip sagebrush, Wyoming big sagebrush and three-tip sagebrush, and mountain big sagebrush and silver sagebrush. Wyoming and mountain big sagebrush can co-dominate areas with tobacco brush (*Ceanothus velutinus*). Rabbitbrush (*Chrysothamnus viscidiflorus*) and short-spine horsebrush (*Tetradymia spinosa*) are common associates and often dominate sites after disturbance. Big sagebrush occurs with the shorter stiff sagebrush (*A. rigida*) or low sagebrush (*A. arbuscula*) on shallow soils or high elevation sites. Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds. Silver sagebrush and rabbitbrush are associates in disturbed areas. When this habitat is in good or better ecological condition, a bunchgrass steppe layer is characteristic. Diagnostic native bunchgrasses that often dominate different Shrub-steppe habitats are (1) mid-grasses: bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), bottlebrush squirreltail (*Elymus elymoides*), and Thurber needlegrass (*Stipa thurberiana*); (2) short grasses: threadleaf sedge (*Carex filifolia*) and Sandberg bluegrass (Poa sandbergii); and (3) the tall grass, basin wildrye (*Leymus cinereus*). Idaho fescue is characteristic of the most productive Shrub-steppe vegetation. Bluebunch wheatgrass is co-dominant at xeric locations, whereas western needlegrass (*Stipa occidentalis*), long-stolon (*Carex inops*) or Geyer's sedge (*C. geyeri*) increase in abundance in higher elevation Shrub-steppe habitats. Needle-and-thread (*Stipa comata)* is the characteristic native bunchgrass on stabilized sandy soils. Indian ricegrass (*Oryzopsis hymenoides*) characterizes dunes. Grass layers on montane sites contain slender wheatgrass (*Elymus trachycaulus*), mountain fescue *(F. brachyphylla*), green fescue (*F. viridula*), Geyer's sedge, or tall bluegrasses (*Poa* spp.). Bottlebrush squirreltail can be locally important in the Columbia Basin, sand dropseed (*Sporobolus cryptandrus*) is important in the Basin and Range and basin wildrye is common in the more alkaline areas. Many sites support non-native plants, primarily cheatgrass (*Bromus tectorum*) or crested wheatgrass (*Agropyron cristatum*) with or without native grasses. Shrub-steppe habitat, depending on site potential and disturbance history, can be rich in forbs or have little forb cover. Trees may be present in some Shrub-steppe habitats, usually as isolated individuals from adjacent forest or woodland habitats.

Other Classifications and Key References. Franklin and Dyrness discussed this habitat in Shrub-steppe zones of Washington and Oregon. Other references describe elements of this habitat.

Natural Disturbance Regime. The fire-return interval for this habitat is 25 years. The native Shrub-steppe habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. With disturbance, mature stands of big sagebrush are reinvaded through soil-stored or windborne seeds. Invasion can be slow because sagebrush is not disseminated over long distances. Site dominance by big sagebrush usually takes a decade or more depending on fire severity and season, seed rain, post-fire moisture, and plant competition. Three-tip sagebrush is a climax species that reestablishes (from seeds or commonly from sprouts) within 5-10 years following a disturbance. Certain disturbance regimes promote three-tip sagebrush and it can out-compete herbaceous species. Bitterbrush is a climax species that plays a seral role colonizing by seed onto rocky and/or pumice soils. Bitterbrush may be declining and may be replaced by woodlands in the absence of fire. Silver sagebrush is a climax species that establishes during early seral stages and coexists with later arriving species. Big sagebrush, rabbitbrush, and short-spine horsebrush invade and can form dense stands after fire or livestock grazing. Frequent or high-intensity fire can create a patchy shrub cover or can eliminate shrub cover and create Eastside Grasslands habitat.

Effects of Management and Anthropogenic Impacts. Shrub density and annual cover increase, whereas bunchgrass density decreases with livestock use. Repeated or intense disturbance, particularly on drier sites, leads to cheatgrass dominance and replacement of native bunchgrasses. Dry and sandy soils are sensitive to grazing, with needle-and-thread replaced by cheatgrass at most sites. These disturbed sites can be converted to modified grasslands in the Agriculture habitat.

Status and Trends. Alteration of fire regimes, fragmentation, livestock grazing, and the addition of >800 exotic plant species have changed the character of Shrub-steppe habitat. Big Sagebrush and Mountain Sagebrush cover types are significantly smaller in area than before 1900, and that Bitterbrush/Bluebunch Wheatgrass cover type is similar to the pre-1900 extent. Basin Big Sagebrush and Big sagebrush-Warm potential vegetation type's successional pathways have been altered, some pathways of Antelope Bitterbrush have been altered and most pathways for Big Sagebrush-Cool are unaltered. Overall this habitat has seen an increase in exotic plant importance and a decrease in native bunchgrasses. More than half of the Pacific Northwest Shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Open Water - Lakes, Rivers, and Streams

Eva L. Greda, David H. Johnson, and Tom O'Neil

Lakes, Ponds, and Reservoirs

Geographical Distribution. Lakes in Washington occur statewide and are found from near sea level to about 10,200 ft above sea level. There are 3,887 lakes and reservoirs in western Washington, and they total 176,920 acres. In contrast, there are 4,073 lakes and reservoirs in eastern Washington that total 436,843 acres.

Physical Setting. Continental glaciers melted and left depressions, where water accumulated and formed many lakes in the region. These kinds of lakes are predominantly found in Lower Puget Sound. Landslides that blocked natural valleys also allowed water to fill in behind them to form lakes, like Crescent Lake, Washington. The lakes in the Cascades and Olympic ranges were formed through glaciation and range in elevation from 2,500 to 5,000 ft. Beavers create many ponds and marshes in Washington. Craters created by extinct volcanoes, like Battleground Lake, Washington, also formed lakes. Human-made reservoirs created by dams impound water that creates lakes behind them, like Bonneville Dam on the main stem of the Columbia River. In the lower Columbia Basin, many lakes formed in depressions and rocky coulees through the process of seepage from irrigation waters.

Structure. There are 4 distinct zones within this aquatic system: (1) the littoral zone at the edge of lakes is the most productive with diverse aquatic beds and emergent wetlands (part of Herbaceous Wetland's habitat); (2) the limnetic zone is deep open water, dominated by phytoplankton and freshwater fish, and extends down to the limits of light penetration; (3) the profundal zone below the limnetic zone, devoid of plant life and dominated with detritivores; (4) and the benthic zone reflecting bottom soil and sediments. Nutrients from the profundal zone are recycled back to upper layers by the spring and fall turnover of the water. Water in temperate climates stratifies because of the changes in water density. The uppermost layer, the epilimnion, is where water is warmer (less dense). Next, the metalimnion or thermocline, is a narrow layer that prevents the mixing of the upper and lowermost layers. The lowest layer is the hypolimnion, with colder and most dense waters. During the fall turnover, the cooled upper layers are mixed with other layers through wind action.

Natural Disturbance Regime. There are seasonal and decadal variations in the patterns of precipitation. In the Coast Range, there is usually one month of drought per year (usually July or August) and two months of drought once in a decade. The Cascades experience one month with no rain every year and a two-month dry period every third year. Dry years with <33 percent of normal precipitation occur once every 30 years along the coast, and

every 30 years in the Cascades. Floods occur in Washington every year. Flooding season west of the Cascades occurs from October through April, with more than half of the floods occurring during December and January. Floods are the result of precipitation and snow melts. Floods west of the Cascades are influenced mostly by precipitation and thus are short-lived, while east of the Cascades floods are caused by melting snow, and the amount of flooding depends on how fast the snow melts. High water levels frequently last up to 60 days.

Effects of Management and Anthropogenic Impacts. Sewage effluents caused eutrophication of Lake Washington in Seattle, where plants increased in biomass and caused decreased light transmission. The situation was corrected, however, before it became serious as a result of a campaign of public education, and timely cleanup of the lake. Irrigation projects aimed at watering drier portions of the landscape may pose flooding dangers, as was the case with Soap Lake and Lake Leonore in eastern Washington. Finally, natural salinity of lakes can decrease as a result of irrigation withdrawal and can change the biota associated with them.

Rivers and Streams

Geographic Distribution. Streams and rivers are distributed statewide in Washington, forming a continuous network connecting high mountain areas to lowlands and the Pacific coast. Washington has more streams than any other state except Alaska. In Washington, the coastal region has 3,783 rivers and streams totaling 8,176 miles. The Puget Sound Region has 10,217 rivers and streams, which add up to 16,600 miles in length. The rivers and streams range from cold, fast-moving high-elevation streams to warmer lowland valley rivers. In all, there are 13,955 rivers and streams that add up to 24,774 miles. There are many more streams in Washington yet to be catalogued.

Physical Setting. Climate of the area's coastal region is very wet. The northern region in Washington is volcanic and bordered to the east by the Olympic Mountain Range, on the north by the Strait of Juan de Fuca, and on the west by the Pacific Ocean. In contrast, the southern portion in Washington is characterized by low-lying, rolling hills. The Puget Sound Region has a wet climate. Most of the streams entering Puget Sound have originated in glacier fields high in the mountains. Water from melting snowpacks and glaciers provide flow during the spring and winter. Annual rainfall in the lowlands ranges from 35 to 50 inches, from 75 to 100 inches in the foothills, and from 100 to >200 inches in the mountains (mostly in the form of snow). The western Cascades in Washington are composed of stable, volcanically derived rocks. They have low sediment-transport rates and stable beds composed largely of cobbles and boulders, which move only during extreme events. Velocities of river flow ranges from as little as 0.2

to 12 mph while large streams have an average annual flow of 10 cubic feet per second or greater. The Cascades and Blue mountains are similar in that they have more runs and glides and fewer pools, similar fish assemblages, and similar water quality.

Landscape setting. This habitat occurs throughout Washington. Ponds, lakes, and reservoirs are typically adjacent to Herbaceous Wetlands, while rivers and streams typically adjoin the Westside Riparian Wetlands, Eastside Riparian Wetlands, Herbaceous Wetlands, or Bays and Estuaries habitats.

Other Classifications and Key References. This habitat is called riverine and lacustrine in Anderson *et al.*, Cowardin *et al.*, Washington GAP Analysis Project, Mayer and Laudenslayer, and Wetzel. Other references describe elements of this habitat.

Effects of Management and Anthropogenic Impacts. Removal of gravel results in reduction of spawning areas for anadromous fish. Overgrazing, and loss of vegetation caused by logging produces increased water temperatures and excessive siltation, harming the invertebrate communities. Incorrectly installed culverts may act as barriers to migrating fish and may contribute to erosion and siltation downstream. Construction of dams is associated with changes in water quality, fish passage, competition between species, loss of spawning areas because of flooding, and declines in native fish populations. Historically, the region's rivers contained more braided multi-channels. Flood control measures such as channel straightening, diking, or removal of streambed material along with urban and agriculture development have all contributed to a loss of oxbows, river meanders, and flood plains. Unauthorized or over-appropriated withdrawals of water from the natural drainages also have caused a loss of open water habitat that has been detrimental to fish and wildlife production, particularly in the summer. Agricultural, industrial, and sewage runoff such as salts, sediments, fertilizers, pesticides, and bacteria harm aquatic species. Sludge and heavy waste buildup in estuaries is harmful to fish and shellfish. Unregulated aerial spraying of pesticides over agricultural areas also poses a threat to aquatic and terrestrial life. Direct loss of habitat and water quality occurs through irrigation. Very large floods may change the channels permanently through the settling of large amounts of sediments from hillslopes, through debris flow, and through movement of large boulders, particularly in the montane areas. Clearcutting creates excessive intermittent runoff conditions and increases erosion and siltation of streams as well as diminishes shade, and therefore causes higher water temperatures, fewer terrestrial and aquatic food organisms, and increased predation. Landslides, which contributed to the widening of the channel, were a direct result of clearcutting. Clearcut logging can alter snow accumulation and increase the size of peak flows during times of snowmelt. Clearcutting and vegetation removal affects the temperatures of streams, increasing them in the summer and decreasing in winter, especially in eastern parts of Washington. Building of roads, especially those of poor quality, can be a major contributor to sedimentation in the streams.

Status and Trends. The principal trend has been in relationship to dam building or channelization for hydroelectric power, flood control, or irrigation purposes. As an example, in 1994, there were >900 dams in Washington alone. The dams vary according to size, primary purpose, and ownership (state, federal, private, local). The first dam and reservoir in Washington was the Monroe Street Dam and Reservoir, built in 1890 at Spokane Falls. Since then the engineering and equipment necessary for dam building developed substantially, culminating in such projects as the Grand Coulee Dam on the Columbia River 214. In response to the damaging effects of dams on the indigenous biota and alteration and destruction of freshwater aquatic habitats, Washington state government questioned the benefits of dams, especially in light of the federal listing of several salmon species. There are now talks of possibly removing small dams to removing large federal dams like those on the lower Snake River,

Herbaceous Wetlands

Rex C. Crawford, Jimmy Kagan, and Christopher B. Chappell

Geographic Distribution. Herbaceous wetlands are found throughout the world and are represented in Washington wherever local hydrologic conditions promote their development. This habitat includes all wetlands except bogs and those within Subalpine Parkland and Alpine. Freshwater aquatic bed habitats are found throughout the Pacific Northwest, usually in isolated sites. They are more widespread in valley bottoms and high rainfall areas (e.g., Puget Trough, coastal terraces, coastal dunes), but are present in montane and arid climates as well. Hardstem bulrush-cattail-burred marshes occur in wet areas throughout Washington. Sedge meadows and montane meadows are common in the Olympic and Cascade Mountains and Okanogan Highlands.

Physical Setting. This habitat is found on permanently flooded sites that are usually associated with oxbow lakes, dune lakes, or potholes. Seasonally to semi-permanently flooded wetlands are found where standing freshwater is present through part of the growing season and the soils stay saturated throughout the season. Some sites are temporarily to seasonally flooded meadows and generally occur on clay, pluvial, or alluvial deposits within montane meadows, or along stream channels in shrubland or woodland riparian vegetation. In general, this habitat is flat, usually with stream or river channels or open water present. Elevation varies from sea level to 10,000 feet, although infrequently above 6,000 ft.

Landscape Setting. Herbaceous wetlands are found in all terrestrial habitats except Subalpine Parkland, Alpine Grasslands, and Shrublands habitats. Herbaceous wetlands commonly form a pattern with Westside and Eastside Riparian-Wetlands and Montane Coniferous Wetlands habitats along stream corridors. These marshes and wetlands also occur in closed basins in a mosaic with open water by lakeshores or ponds. Extensive deflation plain wetlands have developed between Coastal Dunes and Beaches habitat and the Pacific Ocean. Herbaceous wetlands are found in a mosaic with alkali grasslands in the Desert Playa and Salt Scrub habitat.

Structure. The herbaceous wetland habitat is generally a mix of emergent herbaceous plants with a grass-like life form (graminoids). These meadows often occur with deep or shallow water habitats with floating or rooting aquatic forbs. Various wetland communities are found in mosaics or in nearly pure stands of single species. Herbaceous cover is open to dense. The habitat can be comprised of tule marshes >6.6 ft tall or sedge meadows and wetlands <3.3 ft tall. It can be a dense, rhizomatous sward or a tufted graminoid wetland.

Graminoid wetland vegetation generally lacks many forbs, although the open extreme of this type contains a diverse forb component between widely spaced tall tufted grasses.

Composition. Various grasses or grass-like plants dominate or co-dominate these habitats. Cattails (*Typha latifolia*) occur widely, sometimes adjacent to open water with aquatic bed plants. Several bulrush species (*Scirpus acutus, S. tabernaemontani, S. maritimus, S. americanus, S. nevadensis*) occur in nearly pure stands or in mosaics with cattails or sedges (*Carex* spp.). Burreed (*Sparganium angustifolium , S. eurycarpum*) are the most important graminoids in areas with up to 3.3 ft of deep standing water. A variety of sedges characterize this habitat. Some sedges (*Carex aquatilis, C. lasiocarpa, C. scopulorum, C. simulata, C. utriculata, C. vesicaria*) tend to occur in cold to cool environments. Other sedges (*C. aquatilis var. dives, C. angustata, C. interior, C. microptera, C. nebrascensis*) tend to be at lower elevations in milder or warmer environments. Slough sedge (*C. obnupta*), and several rush species (*Juncus falcatus, J. effusus, J. balticus*) are characteristic of coastal dune wetlands that are included in this habitat. Several spike rush species (*Eleocharis* spp.) and rush species can be important. Common grasses that can be local dominants and indicators of this habitat are American sloughgrass (*Beckmannia syzigachne*), bluejoint reedgrass (*Calamagrostis canadensis*), mannagrass (*Glyceria* spp.) and tufted hairgrass (*Deschampsia caespitosa*). Important introduced grasses that increase and can dominate with disturbance in this wetland habitat include reed canary grass (*Phalaris arundinacea*), tall fescue (*Festuca arundinacea*) and Kentucky bluegrass (*Poa pratensis*). Aquatic beds are part of this habitat and support a number of rooted aquatic plants, such as, yellow pond lily (*Nuphar lutea*) and unrooted, floating plants such as pondweeds (*Potamogeton* spp.), duckweed (*Lemna minor*), or water-meals (*Wolffia* spp.). Emergent herbaceous broadleaf plants, such as Pacific water parsley (*Oenanthe sarmentosa*), buckbean (*Menyanthes trifoliata*), water star-warts (*Callitriche* spp.), or bladderworts (*Utricularia* spp.) grow in permanent and semi-permanent standing water. Pacific silverweed (*Argentina egedii*) is common in coastal dune wetlands. Montane meadows occasionally are forb dominated with plants such as arrowleaf groundsel (*Senecio triangularis*) or lady fern (*Athyrium filix-femina*). Climbing nightshade (*Solanum dulcamara*), purple loosestrife (*Lythrum* salicaria), and poison hemlock (Conium maculatum) are common non-native forbs in wetland habitats. Shrubs or trees are not a common part of this herbaceous habitat although willow (*Salix* spp.) or other woody plants occasionally occur along margins, in patches or along streams running through these meadows.

Other Classifications and Key References. This habitat is called palustrine emergent wetlands in Cowardin *et al*. This habitat occurs in both lotic and lentic systems. National Wetland Inventory (NWI) calls this habitat palustrine shrubland. Other references describe elements of this habitat.

Natural Disturbance Regime. This habitat is maintained through a variety of hydrologic regimes that limit or exclude invasion by large woody plants. Habitats are permanently flooded, semi-permanently flooded, or flooded seasonally and may remain saturated through most of the growing season. Most wetlands are resistant to fire and those that are dry enough to burn usually burn in the fall. Most plants are sprouting species and recover quickly. Beavers play an important role in creating ponds and other impoundments in this habitat. Trampling and grazing by large native mammals is a natural process that creates habitat patches and influences tree invasion and success.

Succession and Stand Dynamics. Herbaceous wetlands are often in a mosaic with shrub- or tree-dominated wetland habitat. Woody species can successfully invade emergent wetlands when this herbaceous habitat dries. Emergent wetland plants invade open-water habitat as soil substrate is exposed; e.g., aquatic sedge and Northwest Territory sedge

(*Carex utriculata*) are pioneers following beaver dam breaks. As habitats flood, woody species decrease to patches on higher substrate (soil, organic matter, large woody debris) and emergent plants increase unless the flooding is permanent. Fire suppression can lead to woody species invasion in drier herbaceous wetland habitats.

Effects of Management and Anthropogenic Impacts. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader in roadside ditches. Severe livestock grazing and trampling decreases aquatic sedge, Northwest Territory sedge (*Carex utriculata*), bluejoint reedgrass, and tufted hairgrass. Native species, however, such as Nebraska sedge, Baltic and jointed rush (*Juncus nodosus*), marsh cinquefoil (*Comarum palustris*), and introduced species dandelion (*Taraxacum officinale*), Kentucky bluegrass, spreading bentgrass (*Agrostis stolonifera*), and fowl bluegrass (*Poa palustris*) generally increase with grazing.

Status and Trends. Nationally, herbaceous wetlands have declined and the Pacific Northwest is no exception. These wetlands receive regulatory protection at the national, state, and county level; still, herbaceous wetlands have been filled, drained, grazed, and farmed extensively in the lowlands of Oregon and Washington. Montane wetland habitats are less altered than lowland habitats even though they have undergone modification as well. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. Herbaceous wetlands have decreased along with the diminished influence of beavers on the landscape. Herbaceous wetlands are susceptible to exotic, noxious plant invasions.

Westside Riparian-Wetlands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is patchily distributed in the lowlands throughout the area west of the Cascade Crest. It also occurs less extensively at mid- to higher elevations in the Cascade and Olympic mountains, where it is limited to more specific environments.

Physical Setting. This habitat is characterized by wetland hydrology or soils, periodic riverine flooding, or perennial flowing freshwater. The climate varies from very wet to moderately dry and from mild to cold. Mean annual precipitation ranges from 20 to >150 inches per year. This habitat is found at elevations mostly below 3,000 ft, but it does extend up to 5,500 ft in the form of Sitka alder communities. Wetlands above these elevations are generally considered part of the Subalpine Parkland habitat and are not included here. Topography is typically flat to gently sloping or undulating, but can include moderate to steep slopes in the mountains. Geology is extremely variable. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Flooding regimes include permanently flooded (aquatic portions of small streams), seasonally flooded, saturated, and temporarily flooded. Nutrient-poor acidic bogs, except those high in the mountains, are considered part of this habitat.

Landscape Setting. This habitat typically occupies patches or linear strips within a matrix of forest or regrowing forest. The most frequent matrix habitat is Westside Lowlands Conifer-Hardwood Forest. If not forest, the matrix can be Agriculture, Urban, or Coastal Dunes and Beaches habitats, or rarely Westside Grasslands or Ceanothus-Manzanita Shrublands. This habitat also forms mosaics with or includes small patches of Herbaceous Wetlands. Open Water habitat is often adjacent to Westside Riparian-Wetlands. The major land use of the forested portions of this habitat is timber harvest. Livestock grazing occurs in some areas. Peat mining occurs in some bogs.

Structure. Most often this habitat is either a tall (6-30 ft) deciduous broadleaf shrubland, woodland or forest, or some mosaic of these. Short to medium-tall evergreen shrubs or graminoids and mosses dominate portions of bogs. Trees are evergreen conifers or deciduous broadleaf or a mixture of both. Conifer-dominated wetlands in the lowlands are included here, whereas mid-elevation conifer sites are part of Montane Coniferous Wetlands habitat. Height of the dominant vegetation can be >200 ft. Canopy height and structure

vary greatly. Typical understories are composed of shrubs, forbs, and/or graminoids. Water is sometimes present on the surface for a portion of the year. Large woody debris is abundant in late seral forests and adjacent stream channels. Small stream channels and small backwater channels on larger streams are included in this habitat.

Composition. Red alder (*Alnus rubra*) is the most widespread tree species, but is absent from sphagnum bogs. Other deciduous broadleaf trees that commonly dominate or co-dominate include black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), bigleaf maple (*Acer macrophyllum*), and Oregon ash (*Fraxinus latifolia*). Pacific willow (*Salix lucida* ssp. *lasiandra*) can form woodlands on major floodplains or co-dominate with other willows in tall shrublands. Conifers that frequently dominate or co-dominate include western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*). Grand fir (*Abies grandis*) sometimes co-dominates, especially in drier climates and riverine flood plains. Douglas-fir (*Pseudotsuga menziesii*) is relatively uncommon. Shore pine (*Pinus contorta* var. *contorta*) is common in bogs and in deflation plain wetlands along the outer coast. Dominant species in tall shrublands include Sitka willow (*Salix sitchensis*), Hooker's willow (*Salix hookeriana*), Douglas' spirea (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), western crabapple (*Malus fusca*), salmonberry (*Rubus spectabilis*), stink currant (*Ribes bracteosum*), devil's club (*Oplopanax horridus*), and sweet gale (*Myrica gale*). Labrador tea (*Ledum groenlandicum, L. glandulosum*), western swamp-laurel (*Kalmia microphylla*), sweet gale, and salal (*Gaultheria shallon*) often dominate sphagnum bogs. Vine maple (*Acer circinatum*) or Sitka alder (*Alnus viridis* ssp. *sinuata*) dominate tall shrublands in the mountains that are located on moist talus or in snow avalanche tracks.

Forests and willow, spirea, and dogwood shrublands within this habitat are limited to the area west of the Cascade Crest. Oregon ash communities occur primarily in the southern Puget Lowland (King County south) ecoregion. Sitka spruce communities are mainly found in the Coast Range area and western Olympic Peninsula in areas of coastal fog influence. Sitka alder and vine maple communities are located in the mountains, mainly in western Washington but to a lesser degree on the east slope of the Cascades. Sweet gale communities are found primarily at low elevations on the western Olympic Peninsula. Lodgepole pine-dominated communities are found as bogs in western Washington. Most sphagnum bogs are found in low elevation western Washington.

Shrubs that commonly dominate underneath a tree layer include salmonberry, salal, vine maple, red-osier dogwood, stink currant, Labrador tea, devil's club, thimbleberry (*Rubus parviflorus*), common snowberry (*Symphoricarpos albus*), beaked hazel (*Corylus cornuta*), and Pacific ninebark (*Physocarpus capitatus*). Understory dominant herbs include slough sedge (*Carex obnupta*), Dewey sedge (*C. deweyana*), Sitka sedge (*C. aquatilis* var. *dives*), skunk cabbage (*Lysichiton americanus*), coltsfoot (*Petasites frigidus*), great hedge-nettle (*Stachys ciliata*), youth-on-age (*Tolmiea menziesii*), lady fern (*Athyrium filix-femina*) oxalis (*Oxalis oregana, O. trillifolia*), stinging nettle (*Urtica dioica*), sword fern (*Polystichum munitum*), great burnet (*Sanguisorba officinalis*), scouring rush (*Equisetum hyemalis*), blue wildrye (*Elymus glaucus*), Pacific golden saxifrage (*Chrysoplenium glechomifolium*), and field horsetail (*Equisetum arvense*). Bogs often have areas dominated by more than one species of sedge (*Carex* spp.) or beakrush (*Rhynchospora alba*) and sphagnum moss (*Sphagnum* spp.) that are included within this habitat, despite their lack of woody vegetation. Sphagnum moss is a major ground cover in most bogs.

Other Classifications and Key References. This habitat includes all palustrine, forested wetlands and scrub-shrub wetlands at lower elevations on the westside as well as a small subset of persistent emergent wetlands, those within sphagnum bogs. However, drier portions of this habitat in riparian flood plains may not qualify as wetlands according to Cowardin's definition. They are associated with both lentic and lotic systems. Much of this

habitat is probably not mapped as distinct types by the Gap projects because of its relatively small scale on the landscape and the difficulty of distinguishing forested wetlands. In the Washington Gap project, this habitat occupies portions of open water/wetlands (especially riparian), hardwood forest, and mixed hardwood/conifer forest, and to a minor degree, conifer forest in the following zones: Western hemlock, Sitka spruce, Olympic Douglas-fir, Puget Sound Douglas-fir, Cowlitz River, and Woodland/prairie mosaic. This habitat also occupies much of hardwood forest in the Silver fir, Mountain hemlock portions of Subalpine fir, Interior western hemlock/redcedar, and Grand fir zones. Other references describe this habitat.

Natural Disturbance Regime. The primary natural disturbance is flooding. Flooding frequency and intensity vary greatly with hydrogeomorphic setting. Floods can create new surfaces for primary succession, erode existing streambank communities, deposit sediment and nutrients on existing communities, and selectively kill species not adapted to a particular duration or intensity of flood. Most plant communities are more or less adapted to a particular flooding regime, or they occupy a specific time in a successional sequence after a major disturbance. Debris flows/torrents are also an important, typically infrequent, and severe disturbance where topography is mountainous. Fires were probably infrequent or absent because of the combination of landscape position and site moisture, although fires within the watershed would usually have effects on the habitat through impacts on flooding, sedimentation, and large woody debris inputs. Windthrow of trees can also be significant, especially near important disturbances by changing the hydrology of a stream system through dams. Grazing by native ungulates, e.g. elk, can have a major effect on vegetation.

Succession and Stand Dynamics. Riparian, i.e., streamside, habitats are extremely dynamic. Succession varies greatly depending on the hydrogeomorphic environment. A typical sequence on a riparian terrace on a large stream involves early dominance by Sitka willow, mid-seral dominance by red alder or cottonwood, with a gradual increase in conifers, and eventual late-seral dominance of spruce, redcedar, and/or hemlock. Such a sequence corresponds with increasing terrace height above the bankfull stream stage. Some communities in bogs or depressional wetlands, as opposed to riverine, seem to be relatively stable given a particular flooding regime and environment. Successional sequences are not completely understood and can be complex. Beaver dams or other alterations of flood regime often result in vegetation changes.

Effects of Management and Anthropomorphic Impacts. Intense logging disturbance in conifer or mixed riparian or wetland forests, except bogs, often results in establishment of red alder, and its ensuing long-term dominance. Salmonberry responds similarly to this disturbance and tends to dominate the understory. Logging activities reduce amounts of

large woody debris in streams and remove sources of that debris. Timber harvest can also alter hydrology, most often resulting in post-harvest increases in peak flows. Mass wasting and related disturbances (stream sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Roads and other water diversion/retention structures change watershed hydrology with wide-ranging and diverse effects, including major vegetation changes. The most significant of these are the major flood controlling dams, which have greatly altered the frequency and intensity of bottomland flooding. Increases in nutrients and pollutants are other common anthropogenic impacts, the former with particularly acute effects in bogs. Reed canarygrass (Phalaris arundinacea) is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species occur.

Status and Trends. This habitat occupies relatively small areas and has declined greatly in extent with conversion to urban development and agriculture. What remains is mostly in poor condition, having experienced any of various anthropogenic impacts that have degraded the functionality of these ecosystems: channeling, diking, dams, logging, road building, invasion of exotic species, changes in hydrology and nutrients, and livestock grazing. Current threats include all of the above as well as development. Some protection has been afforded to this habitat through government regulations that vary in their scope and enforcement with jurisdiction. Of the 77 plant associations representing this habitat in the National Vegetation Classification, almost half are considered imperiled or critically imperiled.

Montane Coniferous Wetlands

Christopher B. Chappell

Geographic Distribution. This habitat occurs in mountains throughout much of Washington. This includes the Cascade Range, Olympic Mountains, Okanogan Highlands and Blue Mountains.

Physical Setting. This habitat is typified as forested wetlands or floodplains with a persistent winter snow pack, ranging from moderately to very deep. The climate varies from moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 35 to >200 inches. Elevation is mid- to upper montane, as low as 2,000 ft in northern Washington, to as high as 9,500 ft. Topography is generally mountainous and includes everything from steep mountain slopes to nearly flat valley bottoms. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Subsurface water flow within the rooting zone is common on slopes with impermeable soil layers. Flooding regimes include saturated, seasonally flooded, and temporarily flooded. Seeps and springs are common in this habitat.

Landscape Setting. This habitat occurs along stream courses or as patches, typically small, within a matrix of Montane Mixed Conifer Forest, or less commonly, Eastside Mixed Conifer Forest or Lodgepole Pine Forest and Woodlands. It also can occur adjacent to other wetland habitats: Eastside Riparian-Wetlands, Westside Riparian-Wetlands, or Herbaceous Wetlands. The primary land uses are forestry and watershed protection.

Structure. This is a forest or woodland (>30 percent tree canopy cover) dominated by evergreen conifer trees. Deciduous broadleaf trees are occasionally co-dominant. The understory is dominated by shrubs (most often deciduous and relatively tall), forbs, or graminoids. The forb layer is usually well developed even where a shrub layer is dominant. Canopy structure includes single-storied canopies and complex multi-layered ones. Typical tree sizes range from small to very large. Large woody debris is often a prominent feature, although it can be lacking on less productive sites.

Composition. Indicator tree species for this habitat, any of which can be dominant or co-dominant, are Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), and Alaska yellow-cedar (*Chamaecyparis nootkatensis*) on the westside, and Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), western hemlock (*T. heterophylla*), or western redcedar (*Thuja plicata*) on the eastside. Western hemlock and redcedar are common associates with silver fir on the westside. They are diagnostic of this habitat on the east slope of the central Washington Cascades, and in the Okanogan Highlands, but are not diagnostic there. Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) are sometimes prominent on the eastside. Quaking aspen (*Populus tremuloides*) and black cottonwood (*P. balsamifera* ssp. *trichocarpa*) are in certain instances important to co-dominant, mainly on the eastside. Dominant or co-dominant shrubs include devil's-club (*Oplopanax horridus*), stink currant (*Ribes bracteosum*), black currant (*R. hudsonianum*), swamp gooseberry (*R. lacustre*), salmonberry (*Rubus spectabilis*), red-osier dogwood (*Cornus sericea*), Douglas' spirea (*Spirea douglasii*), common snowberry (*Symphoricarpos albus*), mountain alder (*Alnus incana*), Sitka alder (*Alnus viridis* ssp. *sinuata*), Cascade azalea (*Rhododendron albiflorum*), and glandular Labrador-tea (*Ledum glandulosum*). The dwarf shrub bog blueberry (*Vaccinium uliginosum*) is an occasional understory dominant. Shrubs more typical of adjacent uplands are sometimes co-dominant, especially big huckleberry (*V. membranaceum*), oval-leaf huckleberry (*V. ovalifolium*), grouseberry (*V. scoparium*), and fools huckleberry (*Menziesia ferruginea*). Graminoids that

may dominate the understory include bluejoint reedgrass (*Calamagrostis canadensis*), Holm's Rocky Mountain sedge (*Carex scopulorum*), widefruit sedge (*C. angustata*), and fewflower spikerush (*Eleocharis quinquiflora*). Some of the most abundant forbs and ferns are lady fern (*Athyrium filix-femina*), western oak fern (*Gymnocarpium dryopteris*), field horsetail (*Equisetum arvense*), arrowleaf groundsel (Senecio triangularis), two-flowered marsh marigold (*Caltha leptosepala* ssp. *howellii*), false bugbane (*Trautvetteria carolinensis*), skunk-cabbage (*Lysichiton americanus*), twinflower (*Linnaea borealis*), western bunchberry (*Cornus unalaschkensis*), clasping-leaved twisted-stalk (*Streptopus amplexifolius*), singleleaf foamflower (*Tiarella trifoliata* var. *unifoliata*), and five-leaved bramble (*Rubus pedatus*).

Other Classifications and Key References. This habitat includes nearly all of the wettest forests within the *Abies amabilis* and *Tsuga mertensiana* zones of western Washington and most of the wet forests in the *Tsuga heterophylla* and *Abies lasiocarpa* zones of eastern Washington. On the eastside, they may extend down into the *Abies grandis* zone also. This habitat is not well represented by the GAP projects because of its relatively limited acreage and the difficulty of identification from satellite images. These are primarily palustrine forested wetlands with a seasonally flooded, temporarily flooded, or saturated flooding regime. They occur in both lotic and lentic systems. Other references describe elements of this habitat.

Natural Disturbance Regime. Flooding, debris flow, fire, and wind are the major natural disturbances. Many of these sites are seasonally or temporarily flooded. Floods vary greatly in frequency depending on fluvial position. Floods can deposit new sediments or create new surfaces for primary succession. Debris flows/torrents are major scouring events that reshape stream channels and riparian surfaces, and create opportunities for primary succession and redistribution of woody debris. Fire is more prevalent east of the Cascade Crest. Fires are typically high in severity and can replace entire stands, as these tree species have low fire resistance. Although fires have not been studied specifically in these wetlands, fire frequency is probably low. These wetland areas are less likely to burn than surrounding uplands, and so may sometimes escape extensive burns as old forest refugia. Shallow rooting and wet soils are conducive to windthrow, which is a

common small-scale disturbance that influences forest patterns. Snow avalanches probably disturb portions of this habitat in the northwestern Cascades and Olympic Mountains. Fungal pathogens and insects also act as important small-scale natural disturbances.

Succession and Stand Dynamics. Succession has not been well studied in this habitat. Following disturbance, tall shrubs may dominate for some time, especially mountain alder, stink currant, salmonberry, willows (*Salix* spp.), or Sitka alder. Quaking aspen and black cottonwood in these habitats probably regenerate primarily after floods or fires, and decrease in importance as succession progresses. Pacific silver fir, subalpine fir, or Engelmann spruce would be expected to increase in importance with time since the last major disturbance. Western hemlock, western redcedar, and Alaska yellow-cedar typically maintain co-dominance as stand development progresses because of the frequency of small-scale disturbances and the longevity of these species. Tree size, large woody debris, and canopy layer complexity all increase for at least a few hundred years after fire or other major disturbance.

Effects of Management and Anthropogenic Impacts. Roads and clearcut logging practices can increase the frequency of landslides and resultant debris flows/torrents, as well as sediment loads in streams. This in turn alters hydrologic patterns and the composition and structure of montane riparian habitats. Logging typically reduces large woody debris and canopy structural complexity. Timber harvest on some sites can cause the water table to rise and subsequently prevent trees from establishing. Wind disturbance can be greatly increased by timber harvest in or adjacent to this habitat.

Status and Trends. This habitat is naturally limited in its extent and has probably declined little in area over time. Portions of this habitat have been degraded by the effects of logging, either directly on site or through geohydrologic modifications. This type is probably relatively stable in extent and condition, although it may be locally declining in condition because of logging and road building. Five of 32 plant associations representing this habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Eastside (Interior) Riparian-Wetlands

Rex C. Crawford and Jimmy Kagan

Geographic Distribution. Riparian and wetland habitats dominated by woody plants are found throughout eastern Washington. Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Washington. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Washington at lower elevations. Black cottonwood riparian habitats occur throughout eastern Washington, at low to middle elevations. White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon, Washington, and Idaho, and in western Klickitat and south central Yakima counties, Washington. Quaking aspen wetlands and riparian habitats are widespread but rarely a major component throughout eastern Washington. Ponderosa pine-Douglas-fir riparian habitat occurs only around the periphery of the Columbia Basin in Washington and up into lower montane forests.

Physical Setting. Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100-200 ft from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Eastside riparian and wetland habitats are found from 100-9,500 ft in elevation.

Landscape Setting. Eastside riparian habitats occur along streams, seeps, and lakes within the Eastside Mixed Conifer Forest, Ponderosa Pine Forest and Woodlands, Western Juniper and Mountain Mahogany Woodlands, and part of the Shrub-steppe habitat. This habitat may be described as occupying warm montane and adjacent valley and plain riparian environments.

Structure. The Eastside riparian and wetland habitat contains shrublands, woodlands, and forest communities. Stands are closed to open canopies and often multi-layered. A typical riparian habitat would be a mosaic of forest, woodland, and shrubland patches along a stream course. The tree layer can be dominated by broadleaf, conifer, or mixed canopies. Tall shrub layers, with and without trees, are deciduous and often nearly completely closed thickets. These woody riparian habitats have an undergrowth of low shrubs or dense

patches of grasses, sedges, or forbs. Tall shrub communities (20- 98 ft, occasionally tall enough to be considered woodlands or forests) can be interspersed with sedge meadows or moist, forb-rich grasslands. Intermittently flooded riparian habitat has ground cover composed of steppe grasses and forbs. Rocks and boulders may be a prominent feature in this habitat.

Composition. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), quaking aspen (*P. tremuloides*), white alder (*Alnus rhombifolia*), peachleaf willow (*Salix amygdaloides*) and, in northeast Washington, paper birch (*Betula papyrifera*) are dominant and characteristic tall deciduous trees. Water birch (B. occidentalis), shining willow (*Salix lucida* ssp. *caudata*) and, rarely, mountain alder (*Alnus incana*) are co-dominant to dominant mid-size deciduous trees. Each can be the sole dominant in stands. Conifers can occur in this habitat, rarely in abundance, more often as individual trees. The exception is ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) that characterize a conifer-riparian habitat in portions of the shrub-steppe zones. A wide variety of shrubs are found in association with forest/ woodland versions of this habitat. Red-osier dogwood (*Cornus sericea*), mountain alder, gooseberry (*Ribes* spp.), rose (*Rosa* spp.), common snowberry (*Symphoricarpos albus*) and Drummonds willow (*Salix drummondii*) are important shrubs in this habitat. Bog birch (*B. nana*) and Douglas spirea (*Spiraea douglasii*) can occur in wetter stands. Red-osier dogwood and common snowberry are shade-tolerant and dominate stand interiors, while these and other shrubs occur along forest or woodland edges and openings. Mountain alder is frequently a prominent shrub, especially at middle elevations. Tall shrubs (or small trees) often growing under or with white alder include chokecherry (*Prunus virginiana*), water birch, shining willow, and netleaf hackberry (*Celtis reticulata*). Shrub-dominated communities contain most of the species associated with tree communities. Willow species (*Salix bebbiana, S. boothii, S. exigua, S geyeriana*, or *S. lemmonii*) dominate many sites. Mountain alder can be dominant and is at least codominant at many sites. Chokecherry, water birch, serviceberry (*Amelanchier alnifolia*), black hawthorn (*Crataegus douglasii*), and red-osier dogwood can also be codominant to dominant. Shorter shrubs, Woods rose, spirea, snowberry and gooseberry are usually present in the undergrowth. The herb layer is highly variable and is composed of an assortment of graminoids and broadleaf herbs. Native grasses (*Calamagrostis canadensis, Elymus glaucus*, *Glyceria* spp., and *Agrostis* spp.) and sedges (*Carex aquatilis, C. angustata, C. lanuginosa, C. lasiocarpa, C. nebrascensis, C. microptera*, and *C. utriculata*) are significant in many habitats. Kentucky bluegrass (*Poa pratensis*) can be abundant where heavily grazed in the past. Other weedy grasses, such as orchard grass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), timothy (*Phleum pratense*), bluegrass (*Poa bulbosa, P. compressa*), and tall fescue (Festuca arundinacea) often dominate disturbed areas. A short list of the great variety of forbs that grow in this habitat includes Columbian monkshood (*Aconitum columbianum*), alpine leafybract aster (*Aster foliaceus*), lady fern (*Athyrium filix-femina*), field horsetail (*Equisetum arvense*), cow parsnip (*Heracleum maximum*), skunk cabbage (*Lysichiton americanus*), arrowleaf groundsel (*Senecio triangularis*), stinging nettle (*Urtica dioica*), California false hellebore (*Veratrum californicum*), American speedwell (*Veronica americana*), and pioneer violet (*Viola glabella*).

Other Classifications and Key References. This habitat is called Palustrine scrub-shrub and forest in Cowardin *et al*. This habitat occurs in both lotic and lentic systems. Other references describe elements of this habitat.

Natural Disturbance Regime. This habitat is tightly associated with stream dynamics and hydrology. Flood cycles occur within 20-30 years in most riparian shrublands although flood regimes vary among stream types. Fires recur typically every 25-50 years but fire can be nearly absent in colder regions or on topographically protected streams. Rafted ice and logs

in freshets may cause considerable damage to tree boles in mountain habitats. Beavers crop younger cottonwood and willows and frequently dam side channels in these stands. These forests and woodlands require various flooding regimes and specific substrate conditions for reestablishment. Grazing and trampling is a major influence in altering structure, composition, and function of this habitat; some portions are very sensitive to heavy grazing.

Succession and Stand Dynamics. Riparian vegetation undergoes "typical" stand development that is strongly controlled by the site's initial conditions following flooding and shifts in hydrology. The initial condition of any hydrogeomorphic surface is a sum of the plants that survived the disturbance, plants that can get to the site, and the amount of unoccupied habitat available for invasions. Subsequent or repeated floods or other influences on the initial vegetation select species that can survive or grow in particular life forms. A typical woody riparian habitat dynamic is the invasion of woody and herbaceous plants onto a new alluvial bar away from the main channel. If the bar is not scoured in 20 years, a tall shrub and small deciduous tree stand will develop. Approximately 30 years without disturbance or change in hydrology will allow trees to overtop shrubs and form woodland. Another 50 years without disturbance will allow conifers to invade and in another 50 years a mixed hardwood-conifer stand will develop. Many deciduous tall shrubs and trees cannot be invaded by conifers. Each stage can be reinitiated, held in place, or shunted into different vegetation by changes in stream or wetland hydrology, fire, grazing, or an interaction of those factors.

Effects of Management and Anthropogenic Impacts. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses particularly on fine-textured soils. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use.

Status and Trends. Cottonwood-Willow cover type covers significantly less in area now than before 1900 in the Inland Pacific Northwest. The authors concluded that although riparian shrubland was a minor part of the landscape, occupying two percent, they estimated it to have declined to 0.5 percent of the landscape. Approximately 40 percent of riparian shrublands occurred above 3,280 ft in elevation pre-1900; now nearly 80 percent is found above that elevation. This change reflects losses to agricultural development, roading, dams and other flood-control activities. The current riparian shrublands contain many exotic plant species and generally are less productive than historically. Riparian woodland has always been rare and the change in extent from the past is substantial.

Coastal Dunes and Beaches

Christopher B. Chappell, David H. Johnson and Jimmy Kagan

Geographic Distribution. This habitat occurs primarily along the outer coast of southern Washington. It occurs mainly in Grays Harbor and Pacific counties, and sporadically along the inland marine waters of Clallam, San Juan, Skagit, Jefferson, Whatcom, King, Pierce, Kitsap, Snohomish, and Island counties.

Physical Setting. This habitat occurs primarily in wet, mild outer coastal climates. Precipitation, almost always rain, typically averages >80 inches annually. Summers are relatively dry, but fog is common. Elevation is at and very near sea level, only extending as high as the highest dunes. Topography is mildly to strongly undulating in the form of mostly north-south trending dune ridges and troughs. Soils, when present, are always sandy and are underlain by deep deposits of sand, thereby creating edaphically dry sites. Soils are also very poor in nutrients and organic matter. These dunes, spits, and berms are derived from sand carried by longshore drift and wind erosion. Dunes consist of several types that differ in their physical form, including foredunes, transverse dunes, parabola dunes, and retention ridges. Outlier examples away from the outer coast in the Puget Trough are small in extent, occur in a drier climate, and mainly occur in the form of sand spits and berms as opposed to dunes.

Landscape Setting. This habitat occurs in a natural mosaic with Westside Lowland Conifer-Hardwood Forest, Westside Riparian-Wetlands, and Herbaceous Wetlands. Forests adjacent to this habitat are found on stabilized dunes and are dominated by shore pine (*Pinus contorta* var. *contorta*) and Sitka spruce (*Picea sitchensis*). wooded, shrubby, and herbaceous wetlands occur in seasonally flooded deflation plains or dune troughs. Hooker's willow (*Salix hookeriana*) and slough sedge (*Carex obnupta*) are the two most characteristic species in these wetlands. This habitat is in a mosaic with the Urban habitat, as coastal areas have been developed extensively for tourism and low-density residential uses. Recreation is a major land use and includes the use of off-road vehicles. In southern Washington, the wetlands are often converted to agriculture for cranberries.

Structure. This habitat consists of a variable mosaic of structures ranging from open sand with sparse herbaceous vegetation to dense shrublands. Trees are typically absent but may be scattered. Unstabilized sand may have very little vegetation or open short grasslands or

forb-dominated communities, though these are now relatively uncommon and local. Medium-tall grasslands, typically closed, are a major component in the current landscape. Tall broadleaf evergreen shrubs, typically dense, are also a significant component of the mosaic.

Composition. Where they are vegetated, Unstabilized dunes or strand are typically dominated or co-dominated by American dunegrass (*Leymus mollis*), dune bluegrass (*Poa macrantha*), or Chinook lupine (*Lupinus littoralis*). Red fescue (*Festuca rubra*) was once a major dominant on more stabilized dunes but has been largely replaced by European beachgrass (*Ammophila arenaria*), an introduced species that is now the most common dune grass. Many forb species are largely confined to herb-dominated dunes or strand and may take on local importance. Tall shrublands are dominated primarily by salal (*Gaultheria shallon*) and evergreen huckleberry (*Vaccinium ovatum*), but may also have prominent amounts of hairy manzanita (*Arctostaphylos columbiana*), kinnikinnick (*Arctostaphylos uva-ursi*), bush lupine (*Lupinus arboreus*), or California wax-myrtle (*Myrica californica*). Both Scot's broom (*Cytisus scoparius*) and gorse (*Ulex europaeus*) are exotic shrubs that dominate disturbed areas. Scattered trees are mainly shore pine (*Pinus contorta* var. *contorta*), or, less commonly, Sitka spruce (*Picea sitchensis*).

Other Classifications and Key References. Franklin and Dyrness called this habitat sand dune and strand communities. This habitat is not well represented by the Washington Gap project: it takes up small percentages of several types in the Sitka spruce zone, including conifer forest, hardwood forests, and coastline, sandy beaches, and rocky islands. Other references describe this habitat.

Natural Disturbance Regime. Erosion and deposition of sand are the primary natural processes controlling this habitat. Sand is deposited initially on beaches, and the moved into dunes through wind erosion. Wind also maintains Unstabilized dune areas. Major winter storm events may result in blowouts that create holes in existing stabilized or Unstabilized dunes, crating new areas of sand deposition.

Succession and Stand Dynamics. The different structural variants of the mosaic within this habitat are primarily stages in succession from freshly deposited stand to completely stabilized shrub-dominated dunes. Unstabilized sand, such as foredunes with little European beachgrass, has the most open and herbaceous vegetation. Closing of the vegetation typically results in stabilization of the sand. Recently stabilized dunes are now primarily dominated by European beachgrass. Given more time without a major disturbance, shrubs and/or trees colonize the grasslands. Shrublands are sometimes an intermediate stage in succession toward forests. Pine woodlands are another very common intermediate stage. Eventually, pine woodlands are colonized by Sitka spruce or Douglas-fir and become mixed pine-spruce or pine-Douglas-fir forests. Any one of these stages can be

set back to sand by a blowout or reburial by dunes, and a cyclic successional sequence is common in many areas.

Effects of Management and Anthropogenic Impacts. European beachgrass has been extensively planted for stabilization purposes and has also spread widely on its own. Unstabilized sand is now a relatively rare condition primarily because of the introduction of this species. The physical forms of dunes also have been altered by beachgrass. Forests are probably forming at a greater rate than they did in the past because of increased stabilization. Exotic species, especially sweet vernalgrass (Anthoxanthum odoratum) and common velvetgrass (Holcus lanatus), are now a nearly ubiquitous component of herb-dominated communities. The spread of such species may be related to past livestock grazing in many areas. Scot's broom and gorse are aggressive exotic shrub invaders that were planted for stabilization and have spread widely. Since both are legumes, they result in major nitrogen increases where they establish. Off-road vehicle use has resulted in complete destruction of native herbaceous communities in some areas. Trampling is a potential threat in herbaceous communities.

Status and Trends. This habitat covers a relatively limited area and major expanses of it have been converted to other uses. The vast majority of herbaceous vegetation that remains is in poor condition, being dominated by exotic species. Current tends are probably decreasing in both extent and condition because of continued development in coastal areas and continuing expansion of exotic species into the few remaining native-dominated areas. Six of 11 plant associations currently listed in the National Vegetation Classification representing this habitat are considered imperiled or critically imperiled.

Bays and Estuaries

Mikell O'Mealy and David H. Johnson

Geographic Distribution. This habitat reflects areas with significant mixing of salt and freshwater, including lower reaches of rivers, intertidal sand and mud flats, saltwater and brackish marshes, and open-water portions of associated bays. The habitat is distributed along the marine coast and shoreline of Washington. There are 34 principal bays and estuaries in Washington. The Columbia River estuary is the largest estuary in the Pacific Northwest. This habitat does not include open water areas of Puget Sound (see Inland Marine Deeper Waters). The greater Puget Sound at times is considered a very large estuary; for purposes of this project, Puget Sound is comprised of three wildlife habitats: Bays and Estuaries, Marine Nearshore, and Inland Marine Deeper Waters.

Physical Setting. Climate is moderated by the Pacific Ocean and is usually mild. Mean temperatures at coastal stations generally range from 40 to 70°F year-round with little north-south variation. Annual rainfall along the coastal zone averages 80 to 90 inches and is concentrated in winter months, producing correspondingly high river runoff to bays and estuaries. Elevation is at sea level to a few feet above. Coastal zone topography is characterized by long stretches of sandy beaches broken by steep rocky cliffs, rocky headlands, and the mouths of bays and estuaries. Organics, silt, and sand are the primary substrate components of this habitat and very in specific composition and distribution with variable physical factors.

Landscape Setting. This habitat is adjacent to Westside Riparian-Wetlands, Coastal Dunes and Beaches, Westside Lowland Conifer-Hardwood Forest, Coastal Headlands and Islets, Marine Nearshore, and Inland Marine Deeper Waters habitats. Major uses of bays and estuaries are recreation, tourism, the shellfish industry, and navigation. The terrestrial interface portions of this habitat have been extensively converted for agricultural crop production, livestock grazing, and residential and commercial development. Water channels of many areas have been dredged for ship navigation.

Structure. At the most seaward extent (e.g. river mouths), water depths are shallow (mostly <20 ft) except for dredged channels. This habitat is strongly influenced by the daily tides and currents. Depending on location, mean higher high water to mean lower low water ranges from 6.1 to 10.2 ft. Tidal currents in channels of the principal estuaries typically range from 1 to 5 knots.

Diverse habitats result from riverine discharges and tidal fluxes, salinity, mixing, sedimentation, discharge, and insolation. Unconsolidated or consolidated tideflats are composed of rocks, gravel, sand,

silt and clay as well as abundant organic material. Inundated by daily tidal flows, tideflats may support eelgrass, various algal species, and invertebrate communities. Eelgrass meadows create protected environments and structured habitats for various wildlife species. Salt marshes form at the upper tidal boundary above tideflats. Salt marshes are usually open to closed graminoid or forb communities. Highly branched estuarine channels drain across salt marshes and tideflats, creating a diverse mix of structures. At the most inland extent of this habitat, transitional marsh forms between salt marshes and bordering upland vegetation dominated by grass or woody vegetation.

The Columbia River estuary is characterized as a partially mixed estuary and can be divided into three sections along the salinity gradient: from the mouth to about river mile 7 it is basically marine; from river mile 7 to mile 23 it is transitional (mixing); and above river mile 23 it is fluvial (fresh water).

Composition. Eelgrass meadows stabilize submerged tideflats and are co-dominated by surfgrass and eelgrass species. Three diagnostic surfgrass species (*Phyllospadix scouleri, P. torreyi, P. serrulatus*) occur on rocky substrates in exposed waters, whereas two species of eelgrasses (*Zostera marina, Z. japonica*) are characteristic of mud or mixed mud-sand substrates in areas sheltered from turbulent waters. Highly productive macroalgae that dominate estuarine channels include various blue-green algae, green algae (*Enteromorpha* spp.) and rockweed (*Fucus* spp.). Tideflats bordering salt marshes often are co-dominated by pickleweed (*Salicornia virginica*), arrowgrass (*Triglochin maritima*) and three-square rush (Scirpus americanus). The transition to higher areas of the low-marsh zone is indicated by the dominance of jaumea (*Jaumea carnosa*), saltgrass (*Distichlis spicata*), and Lyngby's sedge (*Carex lyngbyei*). Major components of mid- and high salt marsh areas are alkaligrass (*Puccinellia pumila*) and Canadian sand spurry (*Spergularia canadensis*). Salt rush (*Juncus lesueurii*), tufted hairgrass (*Deschampsia caespitosa*), Pacific silverweed (*Argentina egedii*) and spreading bentgrass (*Agrostis stolonifera*) are salt-tolerant upland species diagnostic of high salt marshes that experience freshwater runoff or riverine discharge.

Other Classifications and Key References. Cowardin et al. included marine and estuarine systems of the Columbia Province. Dethier described a classification for marine and estuarine habitat types in Washington. Habitat types are defined by depth, substratum type, energy level, and a few modifiers. Species (plants and animals) are described for combinations of these physical variables. Harper et al. described a shore-zone sensitivity mapping system. Proctor et al. described an ecological characterization of the Pacific Northwest Coastal Region, including physical and chemical environments as well as socioeconomic aspects of watersheds of the region. Schoch and Dethier provided high-resolution data on the physical features and associated biota of Puget Sound's shorelines using the SCALE model (Shoreline Classification and Landscape Extrapolation). Downing offered a detailed review of the geological and broad ecological development of Puget Sound.

Natural Disturbance Regime. Natural disturbance perpetuates the dynamic, transitional nature of this habitat. Tides, seasonal riverine discharges, winds, storm events, erosion, and accretion are the primary natural processes that shape this habitat. Tides are mixed, characterized by two unequal high and low tides daily, with varying intrusion into estuaries and bays at different locations along the coast. Tides and winds push saltwater wedges up through the system, causing varying degrees of mixing with incoming riverine waters and significant vertical stratification. Riverine discharges and freshwater runoff vary seasonally with precipitation and freshet regimes. Generally, a large range in annual discharge exists with high volumes of fresh water entering the system in winter and significantly reduced flows in summer. Short-term storm events produce dramatic variations in physical habitat

conditions. Sudden erosion or accretion may result from strong oceanic currents at the mouth of the system or from increased freshwater discharges at the head of the system.

Succession and Stand Dynamics. General successional stages reflect unconsolidated barren tideflats to stabilized high salt marshes and salt meadows. Unvegetated tideflats are colonized by pioneer plants, commonly eelgrass, that are tolerant of extended tidal inundation and vary depending on sediment type. Initial colonization causes sediment accretion and gradual rise in land elevation, changes that shift environmental conditions and permit other plants to establish. Arrowgrass, pickleweed, sand spurry, and spike rush can invade the emerging marsh, further increasing and stabilizing substrates. Saltgrass and sedge establish on higher areas of the marsh. When initial colonizers die back, tufted hairgrass and salt rush may establish. Various exotic species have become naturalized in Washington, including spreading bentgrass and sand spurry introduced from Europe, brass buttons (*Cotula coronopifolia*), introduced from South Africa, and marsh cordgrass (*Spartina alterniflora*) introduced form the Atlantic Coast of North America. These successional stages can be disrupted by riverine or tidal scouring and succession can be reinitiated at any point.

Effects of Management and Anthropogenic Impacts. Management, water quality, contaminants, and lad-use practices have altered significant portions of this habitat and continue to impact remaining areas. The dredging and filling of marshes and tideflats to serve various human needs remove estuarine vegetation. Channel flow, tidal inundation, and freshwater discharges are disrupted by construction of seawalls, jetties, dikes, and dams. The physical and chemical conditions of these habitats are degraded by the discharge of municipal, industrial, and agricultural effluents. Functional plant and animal communities are altered by domestic and agricultural runoff of pesticides, herbicides, and fertilizers. Invasions of exotic plants (e.g. Spartina) and invertebrates (e.g. green crabs) pose significant, long-term ecological and economic threats to this habitat. Large tracts of habitat have been lost and converted for coastal development. Additionally, upland activities occurring throughout the watershed, including logging, mining, and hydroelectric power development, can have destructive impacts downstream in estuarine and bay environments.

Status and Trends. Significant quantitative and qualitative alterations of this habitat have occurred with Euro-American settlement. Although natural erosion and accretion processes continue, most habitat modification can be attributed to anthropogenic impacts. Original diking for crop production and flood control, and other more recent barriers, prevent natural recovery and re-establishment of this habitat. Remaining examples of the bay and estuarine habitat exist in various conditions, from the more natural areas, areas undergoing active restoration, to the more prevalent polluted, degraded, or overused areas throughout Washington. With increasing population pressures in coastal areas and the corresponding threats of habitat use and conversion, future trends will likely be continued degradation and reduction of remaining bay and estuarine areas.

Inland Marine Deeper Water

David H. Johnson

Geographic Distribution. This habitat is located in the northwestern portion of Washington. It includes the open waters of the Strait of Georgia, Puget sound, Hood Canal, and the Strait of Juan de Fuca. More specifically, this habitat reflects waters >66 ft. deep, found inland from a line between the Elwha River (just west of Port Angeles) on the Washington side of the Strait of Juan de Fuca, northward to Race Rocks on the southeastern tip of Vancouver Island, British Columbia. This line was independently determined based on (1) kelp distribution, (2) marine bird distribution, and (3) fish species and abundance data. With the exception of Marine Nearshore areas, waters west of this line are considered Marine Shelf.

Physical Setting. This habitat lies largely within the Puget Lowland and northward in Georgia Strait on the east side of Vancouver Island, British Columbia. Mean air temperatures generally range between 40 and 70°F year-round, with little north-south variation. Rainfall averages 20 to 80 inches annually and is concentrated in winter months, producing correspondingly high river runoff to bays, estuaries, and inland marine waters.

Landscape Setting. This habitat is commonly adjacent to Bays and Estuaries, Coastal Headlands and Islets, and Marine Nearshore habitats and merges with the Marine Shelf habitat in the Strait of Juan de Fuca. Inland marine waters are used extensively for navigation, commercial transport of goods, recreation, tourism, and fishery operations.

Structure. A diversity of underwater structures are created as swift tidal currents circulate waters of the Pacific Ocean through the reaches of Straight of Georgia, Puget Sound, Hood Canal and the Strait of Juan de Fuca. Aspects of geology are particularly important in understanding the structure and dynamics of this habitat. Glacial ice initially excavated several long, narrow valleys that today form Lake Washington, Lake Sammamish, Hood Canal, and the major basins of Puget Sound. The arrangement of the present shorelines was established 13,000 years ago when glacial ice retreated from the Puget Lowland. Organics, silt and sand are the primary substrate components of this habitat and vary in

specific composition and distribution with fluctuating physical factors. Through deposition of sediments, major river deltas have advanced substantial distances into the deep basins of Puget Sound.

Composition. Marine waters dominate freshwater influences in areas away from riverine discharges or from the shoreline. Because of the water depths involved, sunlight is diffused, and few if any plants attached to the benthic substrates are capable of growing.

Other Classifications and Key References. Cowardin et al. included this region in the Columbia Province and described a hierarchical classification for wetlands and deepwater habitats in the U.S. Dethier described a classification for marine and estuarine habitat types in Washington. Habitat types were defined by depth, substratum type, energy level, and a few modifiers. Harper et al. described a shore-zone mapping system for use in sensitivity mapping and shoreline countermeasures. Proctor et al. described an ecological characterization of the Pacific Northwest Coastal Region, including physical and chemical environments as well as socioeconomic aspects of watershed units of the region. Schoch and Dethier provided high-resolution data on the physical features and associated biota of Puget Sound's shorelines using the SCALE model (Shoreline Classification and Landscape Extrapolation).

Natural Disturbance Regime. Seasonal and larger, periodically occurring disturbances shape this habitat. Seasonal variation in tidal regimes, precipitation and riverine discharges (winter highs), as well as periodic storm events cause changes in temperature, salinity, energy level, and gradual or sudden erosion and accretion in localized areas.

Successional and Community Dynamics. Diverse plant and invertebrate communities compete for a variety of habitats in this region. Succession occurs in each habitat area as disturbances create temporary vacancies, allowing opportunistic species to become established.

Effects of Management and Anthropogenic Impacts. Land conversion, use, and management have altered significant portions of this habitat. The physical, chemical, and biological condition of some habitats are degraded by both point and nonpoint discharges from municipal and industrial effluents. Functional plant and animal communities are altered by domestic and agricultural runoff of pesticides, herbicides, and fertilizers. Large portions of shoreline have been converted for residential, commercial, and port development, affecting inputs into the adjacent deeper waters. Benthic communities are significantly impacted by maintenance dredging done to support navigation and commerce. The transport of oil and chemical substances creates the potential for harmful spills that can affect these areas for extended periods of time. Passage of vessels from other regions increases the introduction rate of exotic species which, once established, can effectively outcompete native species.

Status and Trends. With the important exceptions of locally increased sedimentation rates and contaminant deposition/retention, the status and trends in the physical and biological aspects of this habitat are poorly known.

Marine Nearshore
David H. Johnson

Geographic Setting. This habitat reflects marine water areas (high tide line to depth of 66 ft) along shorelines not significantly affected by freshwater inputs (i.e. excludes Bays and Estuaries). This includes all marine shorelines of Puget Sound, Hood Canal, San Juan Islands, Straight of Georgia, Strait of Juan de Fuca, and along Washington's outer coastline. In Washington, there are 3,100 miles of this nearshore habitat. For mapping and classification purposes, this habitat does not extend into, or overlap with, shallow or intertidal areas found within Bays and Estuaries.

Physical Setting. The outer coastline of Washington can be characterized as a series of sandy beaches interspersed with rocky headlands. This coastline is oriented in a north-south direction and is subjected to long-fetch, high-energy waves. Nearshore areas within Puget Sound, Hood Canal, and elsewhere landward from the Strait of Juan de Fuca are more protected. With the exception of the far-reaching Columbia River plume, the effects of coastal streams are generally local and seasonal.

Landscape Setting. This habitat is adjacent to the Marine Shelf, Inland Marine Deeper Water, Bays and Estuaries, and a number of terrestrial-based habitats (e.g. Coastal Dunes and Beaches, Westside Lowland Conifer-Hardwood Forest, and Urban). It occurs in a mosaic with Coastal Headlands and Islets.

Structure. Fresh waters drain from lands surrounding these inland marine waters to create estuarine environments nearshore (see Bays and Estuaries habitat). Nearshore subtidal habitats are diversified by degree of wave and current action, availability of sunlight, and presence of vegetation. Submerged unvegetated habitats cover a greater area than do vegetated nearshore habitats, such as salt marshes and eelgrass beds. Various combinations of water depth, character of substrates, and exposure to tidal action create a wide range of benthic habitats. Sand, cobble, boulders, and hardpan are commonly found in areas of moderate to strong currents, whereas silt and clay settle out in protected inlets and bays

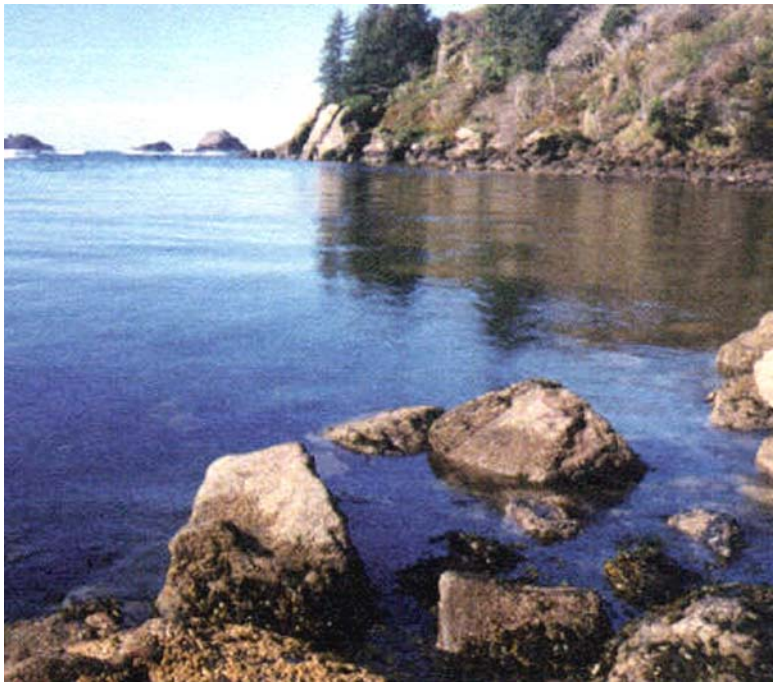
Composition. This habitat supports marine organisms capable of withstanding short-term exposure to air. Bottom substrates in exposed areas are generally rock or sand, but can include cobble or gravel. The subtidal photic zone includes the region from mean low low water (MLLW or the 0 ft depth) to about –50 ft where water is deep enough to prevent sufficient light penetration to the marine floor for primary productivity of kelp and other marine plants. The rocky-bottom intertidal habitats support kelps (*Laminaria* spp., *Lessoniopsis* spp., *Hedophyllum sessile*), brown rockweed (*Pelvetiopsis scouleri*), red algae (*Iridaea* spp.), and surfgrass (*Phyllospadix scouleri*), as well as an abundance and variety of

sessile benthic invertebrates. The larger kelps, such as *Macrocystis integrifolia* and *Nereocystis leutkeana*, are found in the rocky-bottom subtidal areas. Because of constant wave action, the sandy-bottom areas of the intertidal and subtidal zones support few or no plants. The moderate to low energy intertidal and subtidal areas where sand, mud and gravel accumulate support eelgrass (*Zostera marina, Z. japonica*) and the red alga (*Gracilaria pacifica*).

Other Classifications and Key References. Dethier provided a detailed classification scheme for the estuary, intertidal, and shallow subtidal areas of Washington. The Cowardin et al. classification scheme has several limitations with regards to adopting it for marine and estuarine systems. Levings and Thom described nine categories of nearshore habitat in Puget Sound and Georgia Basin.

Natural Disturbance Regimes. This habitat is strongly influenced by tidal rhythms, wave action, storm events, light penetration, and bottom substrate. Because of these factors, this habitat is characterized by a high degree of patchiness; this patchiness leads to differences in its faunal makeup and use. Herbivory by marine invertebrates also causes significant disturbance in plant communities, as evidenced by the direct control of kelp beds by urchin populations.

Succession and Stand Dynamics. The primary natural processes that shape the nearshore habitats include tides, erosion, accretion, and storm events. The rocky surf zone of the outer coast of the Olympic Peninsula includes some of the most complex and diverse shores in the United States. Here, high wave energy provides space for habitation for species as materials are eroded away, and by increasing the capacity of algae to acquire nutrients and use sunlight. Examples of succession can be found on rocky intertidal shores where wave energy periodically disturbs established communities, or in kelp forests where herbivory or the scouring action of swift tidal currents removes vegetation.



Effects of Management and Anthropogenic Impacts. This habitat reflects the interface between land and sea, and is the site of intense commercial and navigational activities, such as seaports, marinas, ferry docks, and log booms. A significant concern is the site-by-site consideration of projects with no ability to account for and assess the cumulative environmental effects of various development activities (from small residential projects to large commercial and industrial development projects). Without the ability to measure or understand cumulative effects, managers are permitting individual activities that may result in dramatic resource losses over time. Making high-quality nearshore vegetation and shoreline characteristics inventory mapping available to land-use planners, natural resource scientists, and the public will increase opportunities to protect this habitat.

Status and Trends. Shoreline modification such as bulkheading, filling, and dredging can lead to direct habitat loss. Indirectly, it can lead to changes in the sediment and wave energy on a beach and in adjacent subtidal areas. One third of Puget Sound's shorelines, approximately 800, has been modified. The Central Puget Sound region, with high human population levels, shows the highest level of modification overall. In Washington there are 26 species of kelp, more than any other area worldwide. Data on floating kelp along the Strait of San Juan de Fuca suggest that while kelp areas are dynamic, the overall extent of kelp has remained stable during 1993-1997.